A. A. R. Mechanical Division Convention Proceedings Number

JULY 6, 1940

# Railway Age

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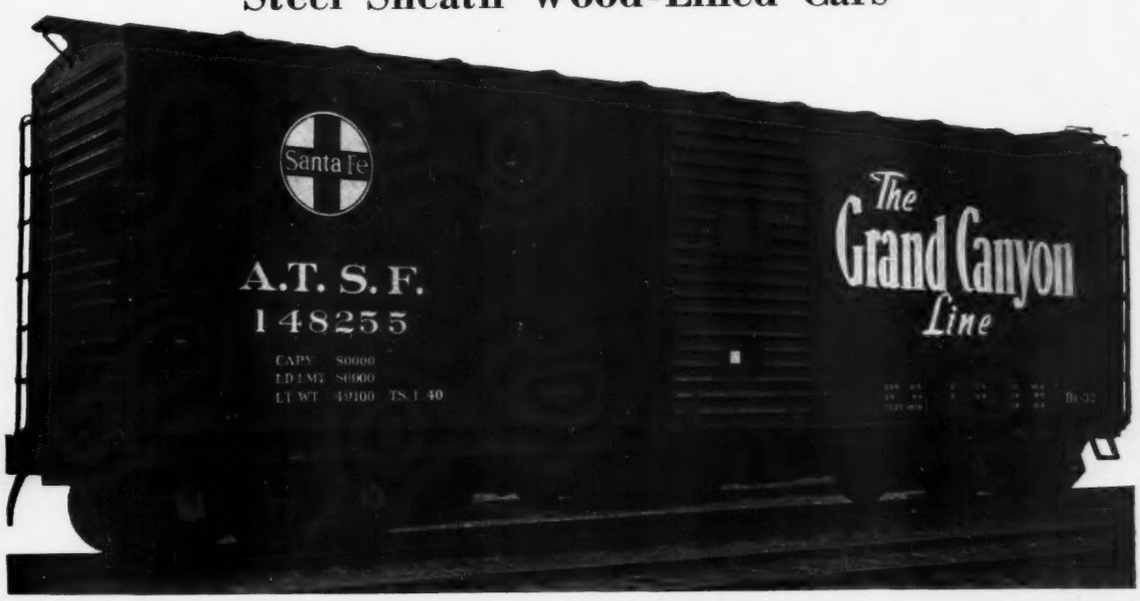


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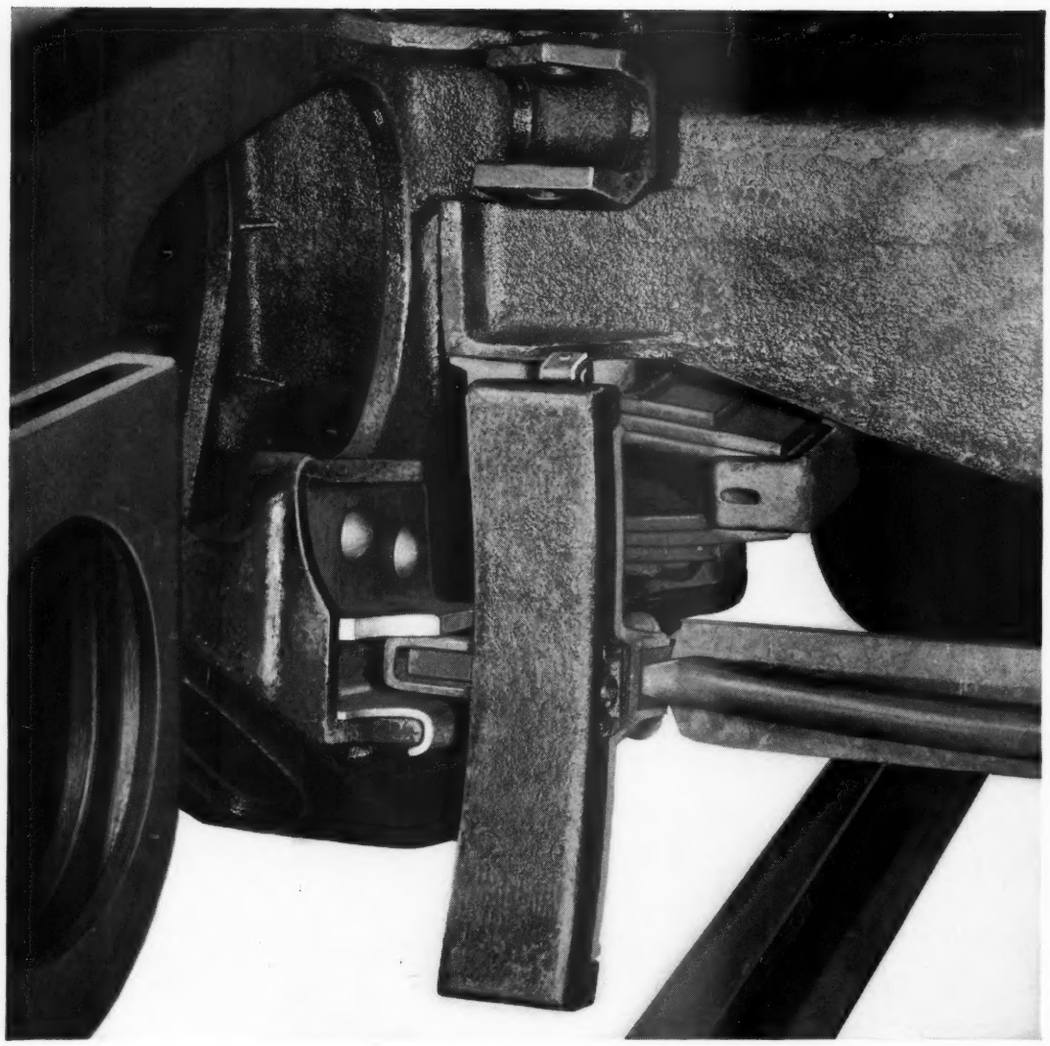

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RAILWAY AGE

# No Reason for Defeatism Regarding Railroads Now

There was never a time in this country when it was so important as now that the custodians of free private enterprise stand up and fight for it and for the moral and political principles upon which its rights are based. For political liberty and economic liberty are inseparable. The man on a government payroll is free only when a vast majority of people are *not* on government payrolls. There are still great opportunities in this country for employment in private enterprise and while this remains true, persons in government employ cannot be deprived of their liberties. Over the entire world, however, including our country, there is sweeping a revolution designed to place all persons virtually or actually on government payrolls. Wherever this has happened—wherever one great monopoly has at its disposal all the available jobs—political liberty has perished.

Private monopolies or quasi-monopolies can be, and are, successfully regulated; but government monopolies cannot be. Against private business monopolies or quasi-monopolies, offsetting monopolies of organized labor can be arrayed—but not against government monopolies, because they deprive labor of its only effective weapon, the right to quit work. Moreover, no private business monopoly can long be maintained, because it always arouses human inventiveness and ingenuity that supplant it. Not so a government monopoly—it brooks no rivals.

### Transferring All Power to Government

In Europe, save only the United Kingdom, the lights of human freedom have gone out. What put them out was the surrender by the people to the state of the function of providing jobs. The German and Italian peoples were poor, and their governments said: "Give us your birthright of freedom, and we will give you a mess of pottage three times a day." The people accepted the proposition, and the principal job their governments have given them is that of killing Englishmen, Dutchmen, Norwegians, Belgians and Frenchmen. Their governments, no more than any other governments anywhere, have any concept of creating wealth. All they know is to take it from other people.

The free peoples—the only ones who, in the long run, produce wealth—have in Europe largely ceased to produce useful things, because who will voluntarily toil laboriously and skillfully if the fruits of his toil are to be taken away? And so the millions in Europe are eating up and wearing out the accumulated savings of their ancestors.

The weak are perishing, while the strong use all their ingenuity and force, not to produce things useful to mankind, but contrivances with which to destroy human life.

This same baleful transfer of individual rights and responsibilities from the people to their rulers has been going on in our own country—and now the totalitarians (i.e., government monopolists) of Europe, without the slightest reason save their desire to enslave and destroy, have marched against the free peoples of Europe and subjugated most of them. The Americas are properly alarmed—because the totalitarians have shown they have no principle save expediency. If they do not attack us, it will not be out of the kindness of their hearts, for they have none, but only because they are persuaded that such an attack might be repulsed. By this country's armament program we are endeavoring to provide the only kind of persuasion which all-powerful statism can understand.

### The Real Enemy—Magnified Governmental Power

But what are we arming against? A German or an Italian, as an individual, is not different from any other individual. He is kind to his family and his friends, and, as an individual, no more cruel or inconsiderate than any other wearers of mortal clay. So we certainly do not need to arm against the millions of individual Germans and individual Italians—*they* would do us no harm. It is only because these unfortunates have been enslaved by government monopolies-of-everything

(which is what totalitarianism means) that they are dangerous to us. We are, that is, arming to protect ourselves against enslavement by a completely monopolistic governmental machine, which would direct and rule our every action.

The most tragic mistake we could make would be to personalize this enemy as the German and the Italian people. *The real enemy is magnified governmental power;* and Americans who strive to build up the power of their own government over the lives and fortunes of the citizens, at the expense of free individual enterprise and responsibility, are just as active and effective attackers of the liberty we seek to defend as are the unfortunate slaves who march in the columns of Europe's tyrants.

### Shall the Real Enemy Triumph at Home?

Unchecked and unlimited government monopoly is the real enemy, because that is the one type of monopoly which, once in power, it is almost impossible to overthrow. Monopoly which controls all the available jobs, and at its pleasure sets wages, working hours and working conditions. Monopoly which controls press and radio—which shuts us off from the truth and fills us up with lies. Monopoly which judges us, not according to law, but according to the whim of the judge. Monopoly which provides advancement, not according to merit, but according to whether you are in favor with the dictator or the party in power. Monopoly which stifles invention and new methods which might destroy its power.

Unless our people can understand what the real enemy is, and fortify against it, the war can be lost here in America, whatever may happen abroad and whether attacks upon us from abroad are made or are repulsed or not. A two-ocean navy and 50,000 airplanes will not protect us against the enemy, except as it may threaten us from the outside. Only our understanding can protect us from the same enemy within the gates. The nomination of Wendell Willkie as the presidential candidate of the Republican party makes it possible to believe that such understanding will soon become widespread in this country. Whether years of dependence on a paternalistic government has so far undermined the character of too many Americans to enable Mr. Willkie to win remains to be seen. But no man in America understands better what are the real issues and the real danger in our present situation. No man, gifted with the ability to deliver the needed message, is more thoroughly aware of the blessings which liberty bestows and of the moral corruption inherent in unlimited governmental power. No man is abler to state and interpret these vital issues in terms which the ordinary man can understand. So, whether Mr. Willkie can be elected or not, the coming campaign cannot fail to afford an historic opportunity for popular education regarding the issue of freedom vs. unrestricted monopoly—i. e., of democracy and private enterprise versus political and economic totalitarianism.

### Our Railways—A Failure by Government

The time, then, is not one for defeatism or compromise with evil. If we love our country well enough to be willing to prepare to defend her, at whatever cost, against invasion by totalitarians from abroad, we should love her and have intelligence enough to protect her from encroachments by government monopoly within our borders.

All these considerations, in our opinion, have a plain and direct bearing on the issue of government ownership of railways raised by Col. William J. Wilgus in a recent address quoted elsewhere in this issue. For Col. Wilgus' views, as those of an eminent former railway officer, regarding the present condition and needs of our railways we have great respect. With his conclusions regarding the way to solve the problem they present we utterly disagree. His is the New Deal attitude of defeatism, an attitude dictated by the belief that private enterprise in this country has failed, whereas our present general economic condition, and the condition of our railways, is due to the fact that government in this country has failed—failed utterly to carry out policies essential to economic recovery in general and to railroad recovery in particular. Did Chamberlain and Daladier stop the spread of totalitarianism in Europe by throwing Czechoslovakia to the wolves? No more would America's defenses against totalitarianism from within or without be strengthened by throwing the railroads to government monopoly. Col. Wilgus is a great engineer; but that apparently is a handicap to him in considering the vital problems with which this country is confronted, because they are so overwhelmingly political and economic—especially the latter.

### Col. Wilgus on Government Ownership

If Colonel Wilgus were a conscious and avowed socialist or fascist his campaign for government ownership would not need to be combated, because the American people are sufficiently on guard against persons frankly wearing those labels. But Colonel Wilgus is not trying to establish a socialist society. On the contrary, he quite correctly believes that the nation is dependent upon efficient railroad service for its defense, and suspects that railroad plant needs replacement and modernization on a large scale in order to make it adequate to our national defense. Taking a long-range view (that is, looking forward four or five years, instead of just a year or 18 months), there is plenty to worry about in the conditions he sets forth about the small amount of expenditure going into railway maintenance, renewal and modernization. What he cites in this connection—although there is much also to be said on the "railroads are ready" theme—is

worthy of the closest attention, particularly his warning that, if this country is drawn into hostilities, it may then be impossible to continue railroad maintenance and renewal even on the hand-to-mouth basis which has obtained for the past decade.

But giving him the benefit of fully crediting the facts as he cites them, it still does not follow that we should adopt his expedient of government ownership as a way out. Why, to defend ourselves against totalitarianism from without, should we voluntarily adopt totalitarianism within? And, if we do, what will there be left worth fighting for? If democracy cannot be sufficiently realistic to so deal with its railroads as an essential part of a system of private enterprise as to enable them to function under that system, then democracy is in a bad way, and it is not the railroads which need drastic remedies, but our democracy itself.

### "Co-operative Management Free from Politics"

And that is exactly what the situation is. Government has meddled, and interfered, and engaged itself in transportation in competition with its own citizens to such an extent that private enterprise transportation is largely profitless. That the railroads have continued to function and give constantly improved service under such treatment speaks volumes for the stamina and resource of private enterprise. It is not a mere *ex parte* opinion of partisans of the railroads that our present transportation chaos springs largely from governmental policy; such is also the opinion of the thoughtful analysts of the Brookings Institution, some of whose views we quoted on page 1150 in our last week's issue.

Col. Wilgus says that under his plan "would go a form of co-operative management, free from politics, in which the five interests involved—executives, labor, shippers, investors and the public-at-large—would take their part." What a naive expectation to be expressed by a man who, in order to discuss this subject wisely, should have read and observed what has occurred in this country and throughout the world. Where has there ever been such "a form of co-operative management (of railways) free from politics?" Nowhere on earth. Always under government management there have been either (1) as in Germany, Italy and Japan governments that kept politics out of management by autocratic means, or (2) democratic governments under which political influence has interfered with efficient management and caused huge deficits for the taxpayers to meet.

Only if we expect the establishment of approximate or complete totalitarianism can we with any reason expect that government railways in this country would be managed "free from politics" and with efficiency; and the longest single step we could take toward the establishment of totalitarianism would be the adoption of government ownership and management of railways —or even the adoption of government management without government ownership.

### Private Enterprise in Railroading Can Succeed

Private enterprise will succeed on the railroads just as thoroughly as it succeeds in any other economic endeavor if government will reverse policies followed by it for seven years that have prevented economic recovery and increase of traffic, and deal with the railroads in a manner consistent with the functioning of private enterprise. Flowers will not grow if weeds are planted among them and the weeds are cultivated and watered while the flowers are not. Neither Colonel Wilgus nor anyone else can point out a single *fundamental* difficulty of the railways which is not traceable to some government policy and which could not be removed by correcting that policy. But no— he says instead, in effect, that, the government having followed policies inconsistent with private enterprise in transportation, let's turn the industry over to those who have nearly wrecked it. *Maybe* they would succeed as operators where they have failed so miserably as regulators and policy-makers; but, frankly, we don't think the argument that they will makes sense.

If we have government-owned railroads, how much competition will they tolerate from highway and waterway carriers? Not much, if experience in other countries where the railroads are government-owned is any criterion. If the government should take over the railroads, there would be a monopoly of transportation here more complete, probably, than that which obtained in the days of the United States Railroad Administration.

### Totalitarianism from Within the Real Danger

Other industries are now being made unattractive to investors by precisely the same kind of governmental policies, precedents for which have been established in dealing with the railroads. Colonel Wilgus apparently would save the rest of our economic life from totalitarianism by throwing the railroads to the totalitarians. But power grows by what it feeds upon. Once the precedent was set of resorting to government monopoly of transportation as a "cure" for conditions for which government policy is responsible, other industries would rapidly succumb to similar attack. With all his good-will, his integrity and his understanding of the engineering, physical aspects of our industrial system, Colonel Wilgus is playing right into the hands of those from whose ideas he would defend us, we fear, because his knowledge of politics and economics is unequal to his knowledge of engineering. His scheme for government ownership and operation of the railroads is "appeasement" such as was tried at Munich, and nothing more.

If the American people and government can be brought to a clearer understanding of the principles on

which our political and economic freedom is based—as now seems not impossible—the evils which beset the railroads will be cured automatically, because the governmental restraints and confusion of policy which have occasioned them will vanish. If the vitality of private enterprise can be permitted to reassert itself, a happier day will dawn for this people—and freedom will have gained the strength it needs to beat back the attacks of organized slavery abroad. A great responsibility, and a great opportunity, have fallen to the railroads and all railroad men in that they must first bear the brunt of the attack of *totalitarianism from within.*

# *Limitations on Price-Fixing Power*

Practicing monopoly pricing, without genuine and complete monopoly power to back up the pricing policy, usually leads to disaster. American economic history of a few decades ago is full of instances of "combines" in various industries, put together at great expense with the idea that they were going to control 90 per cent or more of the business and all of the prices. Few such "combines," even where they didn't go broke, today control anything like the percentage of the market they formerly did.

Managers are not super-men. If they devote all their time and attention to combination and price-fixing, it is quite likely that they will spend proportionately less time and attention upon reducing costs. So the competitor who stays out of the combine and devotes all his energy to increased efficiency and lower costs, finds his competitive job a simple one.

Some years ago a group of retail grocers of a midwestern city organized to end a price war and avert bankruptcy. They raised the price ceiling to where the most inefficient retailer could make some profit. For example, one grocer, operating a 2 x 4 hole-in-the-wall place in a factory district, with an inventory of less than $1,000, was able to own a $1,750 car within two years, in addition to supporting a large family. But not one of the establishments which joined this price-fixing association is in existence today. Protected by their fixed prices, these stores forgot about more efficient management and improvement in merchandising methods, and efficient competition found them out and destroyed them.

Looking over the industrial grave-yard populated so largely by attempts at price-fixing which could not be made to stick, one wonders where those rate-makers derive their confidence who believe that railway and common-carrier truck rates can be successfully established at a uniform level, disregarding the costs at which contract and private truckers can supply the service.

The common carrier trucks were eager to take advantage of the opportunity afforded them to increase their rates which came when the railroads advanced their rates in 1938. When we examine the earnings of the principal truck lines, it is easy to understand why they welcomed this occasion. Reports to the I. C. C. show that large motor carriers east of the Rocky Mountains lost $900,000 in 1937. The 10 per cent increase for the last 9 months of 1938 enabled the same carriers to earn $1,900,000 in that year, and the continued upping of motor carrier rates to the railroad level, and a full year of the 10 per cent increase in 1939, enabled them to earn $5,400,000 in that year.

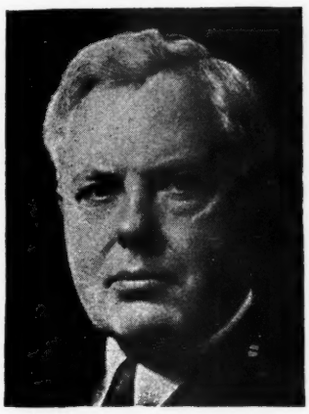
This increase in the railroad rate level enabled the trucks to increase their business by more than 20 per cent—but railroad merchandise revenue was 4 per cent less and manufactures and miscellaneous revenue was 5 per cent less in 1939 than in 1937. Because of their thin earnings and the wage increase they had to meet, the railroads were impelled to take all measures they could to increase their revenues. However, it was contemplated at the time these increases were made that they would not be enforced where important competitive losses would result. Certainly experience has shown that competitive traffic cannot today withstand the handicap of higher rates.

No one friendly to the railroads would advocate the blanket cancellation of the 1938 increases, but certainly merchandise and short-haul carload rates could be adjusted so as to require other agencies of transportation to withdraw into their sound economic radius. Reduced rates which mean no more traffic are not justified, but those which will not only gain traffic, but, take away from competitors the profit which is their incentive for staying in business, are another matter. Moreover, under present conditions, increased traffic to the railroads is largely "velvet." That is, it does not bring a proportional increase in expense. For instance, the carriers in 1939 had to increase operating expenses only 7 per cent in order to increase operating revenues 12 per cent, and this increased net railway operating income 58 per cent. Increased operating expense of 7.4 per cent for the first five months of 1940 increased operating revenues 11.3 per cent and net railway operating income by 55 per cent.

It is difficult to see how the maintenance of rates where competition exists, at a level considerably above the competitors' costs, can do otherwise than bring about further expansion of transportation facilities already too numerous, thinner traffic for existing agencies, higher costs and rates on traffic which remains, and less net revenue for the transportation industry as a whole, and particularly for the railroads.

# Railroads Ready for Emergency, Buford Tells Mechanical Men

## The usual committee reports discussed and acted upon by A. A. R., Mechanical Division—Passenger-car axle research produces new designs



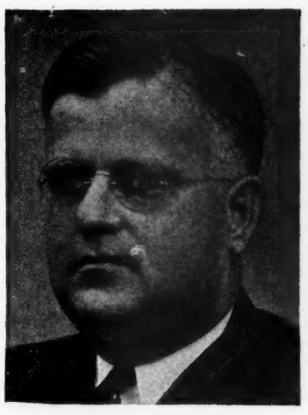
W. H. Flynn, Chairman Elect

F. W. Hankins, Chairman

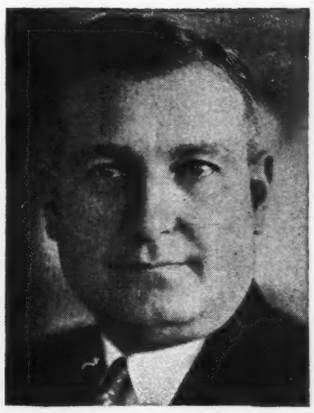
V. R. Hawthorne, Secretary

WITH a program of 13 standing committee reports, several addresses and a special report on Intercrystalline Cracks in Locomotive Boilers before it, the Mechanical Division held its eighteenth annual meeting in the South Ballroom of the Stevens Hotel at Chicago, June 27 and 28. After the meeting was called to order by F. W. Hankins, assistant vice-president and chief of motive power, Pennsylvania, the chairman of the Division, the audience listened to addresses by C. H. Buford, vice-president (operations and maintenance department), Association of American Railroads, by Commissioner W. J. Patterson of the Interstate Commerce Commission, by J. M. Hall, director, Bureau of Locomotive Inspection, Interstate Commerce Commission, and by Chairman Hankins.

Following the addresses and the usual opening business, the General Committee reviewed its actions since the last annual meeting at New York in June, 1939. The committee reported that the membership of the Division at the present time includes 220 railway systems, full members of the Association of American Railroads, and 182 railways, associate members of the A.



D. S. Ellis



O. A. Garber

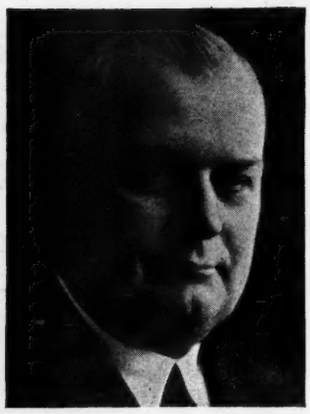
R. G. Henley

J. Purcell

A. L. Ralston

G. C. Christy

H. B. Bowen



E. B. Hall

A. R., and that these railroads, members and associate members of the A. A. R. have appointed 827 representatives in the Mechanical Division. There are in addition, 564 affiliated and 428 life members in the Division.

In referring to the work of the Committee on Loading Rules, the General Committee asked for a resolution to approve its recommendation that new and revised loading rules hereafter be approved by viva voce or rising vote of representatives attending the annual meeting or by the General Committee betwen member meetings without the necessity of letter ballot. The committee pointed out that most changes in these rules are only recommended following extensive experimental shipments and approval or acceptance by the shippers, and that the shippers are demanding that the approval of new rules be expedited so that they can be placed in effect more promptly.

The committee reminded the member roads that as of December 31, 1939, 293,473 railroad owned and 24,621 private-line cars, or a total of 318,094 interchange freight cars, or 15.4 per cent, were equipped with AB brakes. Under date of March 20, 1940, the committee reported that a circular letter had been sent to all car owners asking advice as to what, if any, program had been instituted to comply with the provisions of Interchange Rule 3, section (a), paragraph (4), by January 1, 1945.

The General Committee cited the action taken to provide for the home movement of cars equipped with arch-bar trucks after December 1, 1941, and then called attention to the adoption by letter ballot in February of a modified paragraph (4), section (t), Interchange Rule 3 to prohibit acceptance of cars equipped with arch-bar trucks in interchange, effective July 1, 1940. The modified rule is now published in Supplement No. 1 to the current rules of interchange issued in March, 1940.

Arrangement is being developed by the General Committee to provide dies for the manufacture of parts for the A. A. R. design of auto deck, and that when this arrangement is completed, members will be advised by circular.

*Following the presentation of the General Committee report, a resolution embodying the recommendations of the General Committee with respect to the approval of the Loading Rules without letter ballot was adopted and the actions of the committee since the last meeting approved.*

At the opening of Friday morning's session two interesting educational films were shown to the Mechanical Division by a representative of the United States Secret Service, Treasury Department. The first recounted the process of the manufacture of paper money and United States bonds, showing the various steps in the processes of engraving, printing, inspection, sorting and shipping. The second, entitled "Know Your Money," described the various kinds of paper money and their outstanding

H. H. Urbach

George McCormick

Otto Jabelmann

W. I. Cantley, Mechanical Engineer

characteristics, by the comparison of which with counterfeit money the spuriousness of the latter is most readily detectable.

### Election of Officers

The following candidates proposed by the Nominating Committee were elected as officers and members of the General Committee: W. H. Flynn, general superintendent motive power and rolling stock, New York Central, chairman (2-year term); R. G. Henley, superintendent motive power, Norfolk & Western, vice-chairman (2-year term); members of the General Committee (2-year term): F. W. Hankins, assistant vice-president-chief motive power, Pennsylvania; D. S. Ellis, chief mechanical officer, Chesapeake & Ohio; O. A. Garber, chief mechanical officer, Missouri Pacific; J. Purcell, assistant to vice-president, Atchison, Topeka & Santa Fe; A. L. Ralston, general mechanical superintendent, New York, New Haven & Hartford; and G. C. Christy, general superintendent of equipment, Illinois Central.

## Address by C. H. Buford

The railroads today constitute one of the first lines of defense of the country. Due to the splendid work of standardization of equipment and operating methods which has been carried on by the various railroad departments, the railroads were never in better shape to face such a task than they are today.

The early founders of your Association realized the importance of exact information that could be obtained only through tests conducted under careful supervision, which is sometimes designated as applied research. In looking through the file of your proceedings, we find that as far back as 1875, you were engaged in testing practically all of the various parts of cars and locomotives. In a great deal of this work, laboratories were utilized much as they are today, including those of Stevens Institute of Technology, Purdue University, and the laboratories of a number of railroads and railway equipment companies. Then, as now, the various groups of industries supplying materials and equipment to the railroads cooperated wholeheartedly in this work.

As a result of this coordinated study of your problems through the years, railroad motive power and rolling stock have kept pace with changing conditions and ever-increasing demands. This research and testing has contributed to the present efficient and safe operation of our railroads.

In more recent years, your division has conducted extensive research and tests on such important subjects as air brakes, freight car trucks designed for high-speed service, condensation in freight cars, draft gears, spring snubbers, etc. At the present time, you are making extensive tests of passenger car axles, and at this meeting, as a result of this research, you are recommending the adoption of modified design for passenger car axles for high-speed service.

### Research Points the Way to Further Improvements

These tests and this research point the way to further advances in the art of design of railroad equipment to meet conditions which are becoming more and more exacting. Much credit also belongs to the manufacturers of materials and equipment which the railroads use. With your cooperation, these companies are continually experimenting in their shops and laboratories with improved methods, materials and equipment which are perfected for use.

There must be no letup in your program of advancement in knowledge and development. If the railroads are to continue to fulfill their carrier obligations and be able to expand and improve their services to meet changing conditions, you must continue the vigorous and courageous exploration of all possible means to increase the efficiency, dependability, safety and economy of the railroad service as it is affected by equipment and the facilities under your jurisdiction.

### Prompt Prosecution Recommended

Another point I want to mention is the need for prompt prosecution of any test or research problem under consideration. I refer not only to problems that are strictly mechanical, but also to those that have to be worked out jointly with other divisions or sections of the Association. I note that at this meeting, your committees are presenting completed reports on a number of important matters, along with progress reports on other subjects. I believe the position of Mechanical Engineer which was established on the recommendation of your General Committee about two and a half years ago has contributed to the prompt handling of many matters.

The officers of the association and your Board of Directors appreciate the thorough and efficient manner in which you are handling your work. We recognize and value the achievements of the men in the mechanical departments of our railroads for the remarkable way in which they, in the face of the worst depression in our history and with reduced forces, have done their part in speeding up railroad operation, and the successful introduction of new forms of motor power, equipment and materials. In spite of the generally poor business conditions and the trying times we have experienced during the past few years, the railroads are giving better and more economical service today than ever before.

### Railroads Essential to National Defense

I have said that the railroads constitute one of the first lines of defense of this country. The railroads have always recognized that fact, and even through the depression years have been working with the War Planning Board to determine the means and methods required to best serve the nation in the event of a grave emergency.

Now that our country is starting on a large and much-needed program of national defense, there are some who question the ability of the railroads to handle whatever increase in business may materialize. No one knows what the increase will be, but there are those who make a guess, based on some business index they select. They then count the number of locomotives and cars owned by the railroads, find out the age of the units of equipment, and, using their guess as to the prospective traffic to be moved, tell us how many thousand locomotives and how many hundred thousand cars the railroads should buy.

Some of this advice comes to us from those who have had no railroad experience except such as they get from a study of statistics, and even then they have not considered or do not know how to evaluate all of the statistics bearing on the subject.

It is generally accepted that if we need legal advice, we should go to a lawyer, and if we need medical advice, we should go to a doctor. It follows that if information is wanted about railroads, the railroads themselves should furnish it. The Association of American Railroads, which represents practically all of the Class I railroads in the United States, has just completed a study of the equipment situation on its member lines, and I want to

give you the results of that study. I do this because some of you here today are interested in industries which furnish cars and locomotives to the railroads, and are probably wondering if there is immediate prospect for large orders for rolling stock.

**Equipped to Handle Expected Traffic Peak This Fall**

As of June 1st this year, the railroads had 35,784 more serviceable cars than they had in October, 1939, at which time the average loading was 843,736 cars per week with a peak of 861,000 cars in the week ending October 21. With the new cars on order and the number that can be placed in service by repairs, we will have sufficient equipment to handle a much higher peak load this fall than was handled in 1939. From a careful study of our loading record during the World War and since that time, we can find no basis for an estimated loading at the peak this year that will be in excess of what the railroads can handle.

Unless there is a real need for additional equipment, or unless there is some economy to be gained by adding cars and locomotives, there is no reason why railroads should buy them or should even put money into repairing bad-order equipment. The railroads do not now need more equipment than they have. The only reason, therefore, that railroads might be expected to purchase more equipment would be to reduce operating costs. Wherever opportunities of that sort exist, and especially considering low interest rates and higher prices for the scrap in the old unit, railroads might be interested in additional equipment.

In closing, I want to thank the officers of the Mechanical Division and also the committee chairmen and members for the efficient and cooperative manner in which they have conducted the affairs of the division during the past year.

## Chairman Hankins Address

Since the meeting of the Mechanical Division held in New York City last year, the members of your General Committee and your officers have been confronted with a number of problems. A review of these is contained in the report of the General Committee that will be presented to you at this session.

The improvement in general business conditions during the past year has imposed additional problems. Forecasts of the Shippers' Regional Advisory Boards indicates a further considerable increase in business for the railroads for the year 1940. With the decrease in ownership of freight cars during the past ten years, it is important that bad order cars be kept at the minimum and that serviceable cars be utilized to the greatest extent possible. By reason of improved materials and methods of construction and repairs, a lesser number of freight cars of today can perform more transportation service than a greater number of cars of older types. Improved motive power and transportation methods provide also for quicker turn-around of freight cars, resulting in the cars handling more loads and making greater revenue mileage a year.

Much is yet to be accomplished in improving the motive power and equipment. The arch-bar truck has been eliminated from interchange, but improvement in trucks is imperative to enable freight to be handled more expeditiously and without damage. As conditions permit, application should be expedited of the improved freight brake and certified draft gear to improve train handling and lessen damage to lading and equipment with the quickening of train schedules.

During the past year, upon recommendation of your General Committee, tests were conducted of trucks designed for high-speed freight service. Report of these tests will make available to truck manufacturers information and data upon which to base their designs of trucks for high-speed freight service, indicating the direction in which they should be developed.

The research program of this division for passenger car axles has resulted in recommendation by the Committee on Car Construction for adoption of new design of axle for the various journal sizes for new passenger cars. Further research is being conducted to develop the best specification for material for axles for heavy-duty service. This will be prosecuted so that final recommendation will be available early next year.

The report of the General Committee recommends the adoption of new or revised loading rules without their submission to letter ballot. The recommendations of the Committee on Loading Rules are based on cooperative studies with the shippers. You are requested to approve this recommendation, which will expedite the adoption and use of new and improved methods of securing freight to open-top cars. Increased freight train speed calls for prompt action to improve the methods of securing commodities on open-top cars whenever it is shown that such action is desirable.

Complaints have been made to the General Committee that excessive repairs are being made to foreign cars—especially to empty cars that are delivered to owners by direct connection immediately after completion of repairs. The member roads were requested by your General Committee to report their bills against foreign and private car lines on a car-day basis for a period of eighteen months. After analysis of these reports, special investigations were made where billing was out of line with the average. As a result, the Arbitration and Price Committees are reviewing all labor and material allowances in the Interchange Rules, to the end that such allowances will be established so as to reimburse the repairing line for labor, material and overhead expense incurred in repairing foreign cars and contain no element of profit. While the survey is not yet completed, the Price Committee in its report for this year is recommending such readjustment in material prices and labor allowances as is indicated to be necessary. The Arbitration Committee is recommending revision of Interchange Rule No. 1 to make clear the intent that repairs should be made by the car owner insofar as may be practicable, and that repairs to foreign cars shall be confined to the minimum necessary for safety of operation.

Shippers of heavy freight—sheet steel in bundles, coiled strips, etc.—have adopted a practice of loading these commodities in box cars by the use of lift-truck tractors that impose loads on floors of box cars at the doorway that were never contemplated when the present car designs were prepared and adopted. The Car Construction Committee is recommending reinforcement for car floors used in such service. The Car Construction Committee recommends also a standard contour for passenger cars.

Both of these recommendations should have your careful consideration.

The Committee on Couplers and Draft Gears during the past year has carefully reviewed the experience of the member roads with the tight lock coupler that was adopted as Recommended Practice in 1937 and last revised in 1939. As a result of this study, Circular No. DV.-977 was issued under date of April 3, 1940, containing instructions for making adjustments to improve lock anti-creep. On the same date, there was issued Circular No. D. V.-976 containing revised instructions

governing operation, inspection and maintenance of tight-lock couplers.

The report of the Committee on Wheels, which will be discussed at this meeting, contains important recommendations for revision and improvement of specifications for cast iron wheels and the adoption of specifications for heat-treated wrought steel wheels. This report is commended to your careful and thoughtful consideration.

The report of the Committee on Locomotive Construction contains much useful information. This committee reports on a number of important phases of locomotive design. I am sure that the committee members will be glad to discuss with you any of the matters referred to therein.

All of the committee reports that will be discussed at this meeting represent careful and painstaking effort on the part of your committees. It has been our purpose not to point out the work of any particular committee, but to refer to some of the important matters covered in this year's reports and to direct your attention to all of the reports that will come before you for your discussion and disposition.

### Patterson Speaks to Mechanical Division

W. J. Patterson, member, Interstate Commerce Commission, in speaking briefly to the opening session of the Mechanical Division, said that his remarks would largely be related to matters with which he was formerly deeply concerned as director of the Bureau of Safety, since his work as commissioner had not been closely related to matters with which the members of the Mechanical Division are concerned. He expressed the hope that by July 1 the arch-bar truck would be completely extinct. He also emphasized the need for action in carrying out the program of replacing the old freight-car brakes with the improved type brake. The development of brakes for operation in high-speed service, he said, had been more rapid in passenger service than in freight. He cited as evidence of the need for a higher braking ratio on heavily loaded cars, a case in which a freight train approaching a junction at a relatively slow speed overran the switch and was sideswiped by a train on the main track. Investigation, he said, would probably show that the braking ratio on this train was down around 16 per cent, which he considers to be entirely too low.

Mr. Patterson commented particularly with respect to free slack in freight-car couplers. He said that he based his opinion on the fact that fewer break-in-twos are now occurring as the result of free slack or of the dropping of couplers.

Progress was being made, Mr. Patterson said, in the design of lightweight passenger rolling stock to insure safety of the new designs. He referred to the development of equipment and facilities for the testing of full-size samples of new designs and recommended that no new designs be established without a sample first being subjected to a suitable test. He expressed his confidence in the tight-lock coupler designed to take a vertical load of 100,000 to 150,000 lb. as an important safety device in passenger service. In case of derailment or wreck from other causes, such couplers tend to keep the train in line and thus avoid the unpredictable type of structural failures which may occur when the cars separate and are thrown violently out of line.

Mr. Patterson emphasized the importance of terminal inspection of air brakes, which some railroads are inclined to neglect, in insuring the control of trains under all conditions on the road. He also reminded the railroads that the constitutionality of the stoker order has been established by the Federal Court of the United States, and that the Interstate Commerce Commission has no authority to make any exceptions to the application of the order unless the applicant is clearly outside its scope.

### Remarks by Director Hall

J. M. Hall, director, Bureau of Locomotive Inspection, Interstate Commerce Commission, called upon by Chairman Hankins, reiterated Commissioner Patterson's caution concerning the holding off too long on the equipment of locomotives with stokers. He reminded the members that the stoker order requires equipment of 20 per cent of the locomotives requiring stokers each year during the five-year period within which the work must be completed.

Mr. Hall also suggested that it would be well for the roads not to get caught on the last year within which the equipment of locomotives with power reverse gears must be completed with too large a part of the program still ahead of them.

Some roads, he said, are reluctant to equip their steam-locomotive water glasses with quick-closing valves. In such cases, he said, it was the practice of some enginemen after testing the glass not to open the valves wide but merely to crack them in order that they may be closed quickly and thus guard the men against burns, should the glass break. This, he said, is contrary to good practice in the matter of assuring free openings between the boiler and the water glass, and may result in false water indication.

In commenting on previous remarks concerning the need for more equipment, he suggested that things are moving pretty fast in Europe and that one is not likely to be given much time to meet changing conditions. He cited the case of one important road on which 27.6 per cent of the locomotives are now in or awaiting shop. This he does not consider particularly safe preparation for the future, whatever the situation may be as to the adequacy of the actual number of cars and locomotives owned.

In commenting on the inspection of locomotives other than steam, Mr. Hall said that there was no rule as to exactly what employee should make the inspection of these locomotives, so long as he was competent. He referred to the desire of some roads to have inspections done by the engineman since by this means it becomes unnecessary to bring the locomotive into the engine terminal. This, he said, is not objected to, but the inspection must be made. Seat-box inspections by the engineer are utterly inadequate to locate and report such defects as cracked wheel flanges, checked spring bands, cracks in the bolsters and other similar defects.

## Report on Lubrication of Cars and Locomotives

Your committee held two meetings during the past year devoted to the questions of business held over from previous years or new business referred to it through the office of the secretary, or former chairman, E. L. Johnson.

The subject of the lubrication of steam and Diesel locomotives was covered in considerable detail in the 1939 report of your committee and, since no new subjects pertaining to locomotive lubrication have come up during the year, our report this year covers general subjects relating to the lubrication of car equipment only.

Last year's report included suggested revision of the current specifications M-903-34 recommended by the committee to be

circularized among the members of the Association for comment. During the year suggestions and criticisms have been received and samples of dust guards from a number of manufacturers accumulated by a sub-committee who report progress only for this year. The sub-committee is undertaking further study and tests with a view of developing recommendations for a revision of specifications M-903 to include some limitations covering materials and workmanship. The dimensional modifications proposed during 1938-1939 of the upper portion of the guards to prevent forcing out the top dust-guard well wedges has been approved by the association during the year.

## Interchange Rule No. 66

During the year a number of subjects relating to proposed changes or additions to clauses of Rule No. 66 were referred to and handled by the committee as follows:

Question of owners' vs. handling-line responsibility for imbedded waste grabs in journal bearings.

*Action:* Committee unanimously of the opinion that Section (j) should not be amended to include imbedded waste grab in journal bearing as owners' responsibility.

Question of condemning limit for end wear of freight-car journal bearings as applied to bearings originally applied shorter than standard.

*Action:* The interpretation by the majority of the committee members was that paragraph (j-2) covers end wear based on the standard journal-bearing length and that no change is necessary to apply the limits of end wear as therein stated to worn bearings originally applied having length shorter than standard.

Proposed that free oiling journal boxes—freight equipment in interchange be made mandatory.

*Action:* The action of the committee based on the majority opinion of the members was that it would not be desirable to incorporate in the Rules a requirement to cover the use of free oil, but that its use be left as at present to the judgment of the individual road.

Standard method of packing journal boxes—present "one-piece" vs. proposed "roll method."

*Action:* Opinion of committee members divided as between the two methods of packing boxes: both methods considered satisfactory. Tests to be undertaken during coming year by several members on their roads in endeavor to develop facts based on comparative service performance. No definite recommendation for change from present standard at this time.

Proposed setting up of labor price (Rule 107) to cover trimming over-run babbitt on journal bearings with "brass-trimming machines" at periodic re-packing periods required by Rule No. 66.

*Action:* After full discussion of the proposition involved in the use of the brass trimming machines and the practice of trimming the over-run lining of bearings otherwise serviceable and replacing them on the same journals for further service, the committee does not recommend the practice of trimming journal bearings on cars of foreign ownership.

## Joint Sub-Committee on Journal Boxes and Contained Parts

This joint sub-committee having membership from the Committee on Car Construction and the Committee on Lubrication of Cars and Locomotives held two meetings during the year. The subjects handled, as they had bearing on the question of lubrication, included: (1) Question of dimensional changes in journal bearing design as related to the over-heating of 6½-in. by 12-in. bearings in locomotive tender service; (2) question of modification in the roof in the inside of journal boxes A, B, C, D, E, and F, to provide better contact surface between roof and wedge and thereby permit of proper movement and alignment to reduce bearing over-heatings; (3) question of waste-retaining ribs in journal boxes to prevent packing rolling and over-heatings due to strands getting between journals and bearings; and, (4) consideration of the question of dimensional modifications and reducing manufacturing and running tolerances of parts comprising the journal box assembly with a view of better control of lateral and a consequent reduction in over-heatings attributable to the lubrication of parts taking the lateral thrust.

Inasmuch as the final action on the above questions all involve dimensional changes and the design of parts, they come properly under the jurisdiction of the Committee on Car Construction and will not, therefore, be other than referred to in this report.

## Report of Joint Sub-Committee on Journal-Box Lubricating Materials

Your joint sub-committee, since its authorization on May 27, 1936, has carried out studies of journal-box lubricating materials and has made annual reports to you with such suggestions for revision of the oil, waste, and packing specifications as were deemed justified by the information developed through surveys and tests carried out each year. A brief review of the work carried out during the past four years is summarized in this year's report.

### 1936-1938 Survey of Renovated Oils, Wastes, and Packings from 17 Railroads

Information pertaining to facilities and methods of renovation and samples of oils, wastes, and packings representing renovated journal box materials were secured from each of the member roads represented on the 1936 Specifications and Lubrication Committees, and the Southern Pacific. Samples representing 17 oils, 26 wastes, and 22 saturated packings were received from the Atchison, Topeka & Santa Fe; Baltimore & Ohio; Chesapeake & Ohio; Chicago, Burlington & Quincy; Chicago, Milwaukee, St. Paul & Pacific; Chicago & North Western; Chicago, Rock Island & Pacific; Delaware & Hudson; Illinois Central; Missouri Pacific; New York Central; New York, New Haven & Hartford; Northern Pacific; Pennsylvania; Southern Pacific, and Southern.

The samples were furnished in triplicate and analyzed in the A. T. & S. F., Mo. Pac. and N. Y. C. laboratories to determine the values of 14 items using methods commonly accepted as standard, previously agreed to or developed during the progress of the work. Some study of special apparatus for the analysis of saturated packing was made, but abandoned in favor of the method finally recommended. Detailed results of this survey were reported to the membership of the two committees under date of May 22, 1938, with recommendations for revision of the renovated car-oil specification as M-904-38, and a new specification for renovated journal-box waste and packing as M-910-38.

These specifications were recommended by the committees for circularization among the members of the Association as information, and were published in Circular No. DV-938, dated Chicago, August 26, 1938. Comments and criticisms received from the member roads through the secretary's office were studied at a meeting of your joint sub-committee on December 19, 1938.

The classification of the comments on the suggested revision of specifications M-904-38 for renovated car oil showed:

| | |
|---|---|
| Roads in favor, or in favor with minor suggested modifications | 28 |
| Roads in favor in general, but suggesting deletions, changes, or additions | 14 |
| Roads against, or favoring retention of present specification M-904-36 | 15 |
| Total number of roads making comments | 57 |

The classification of the comments on the suggested new specifications M-910-38 for renovated journal-box waste and packing showed:

| | |
|---|---|
| Roads in favor, or in favor with minor suggested modifications | 39 |
| Roads in favor in general, but suggesting deletions, changes, or additions | 9 |
| Roads against, or favoring the current specification (Rule 66) | 8 |
| Total number of roads making comments | 56 |

Based on study of the comments and criticism received from the membership of the association, the specifications were revised and resubmitted to the members of the committees under date of December 22, 1938, as M-904-39, and M-910-39.

### 1939 Ivestigations of "Precipitants" and "Ash" —Specifications Committee Member Laboratories

Joint sub-committee's draft of specifications M-910-39 approved

by Specifications Committee at meeting held January 11-12, 1939, but action on specifications M-904 deferred and further investigation of "precipitants" and a study of the method of "ash" determination of renovated car oils in the laboratories of all members authorized.

To this end, the chairman of the joint sub-committee distributed a divided sample of renovated car oil and portions of petroleum naphtha secured from one refinery to meet the specification of A. S. T. M. "precipitation naphtha" (method D-91-35), to each member of the Specifications Committee. The 11 laboratories represented made determinations of "tarry matter" and "insoluble impurities (dirt)" by the methods specified in specifications M-904-39, and "precipitation number" by the method specified in M-904-36 (A. S. T. M. D-9133). In addition to the check of the common sample of renovated car oil with the A. S. T. M. "precipitation naphtha" furnished each member from a common source, the same determinations were made on the common oil sample, using: (1) 40-60 deg. C. boiling-point gasoline furnished each member by the New York Central laboratory, (2) petroleum naphthas in stock in members' laboratories, and (3) commercial "stove and lighting naphtha," specifications M-910-39. In addition, the same determinations were made by each member, using the same four precipitants, on samples of renovated car oil representing each member's product as of January-February, 1939. Each member also reported determinations of "ash" of the common sample of renovated car oil by two methods furnished each member. Results of these investigations are shown in the Tables I, II, and III attached as Exhibits A, B, and C.

(These tables are not included in this abstract.)

### Joint Meeting of Specifications and Lubrication Committees

A joint meeting of the two committees on February 28, 1939, was devoted to a review of the joint sub-committee's recommended 1939 revised drafts of specifications M-904 and M-910, discussion of the results of the research on "precipitants" and "ash" completed by the Specifications Committee, methods of renovating car oil and waste followed by member roads, and the items and values for the specification requirements. The final action of the joint session was to approve a revised draft of specifications M-904-36, and to approve the draft of specifications M-910-39 as previously revised by the Specifications Committee on January 12, 1939. These drafts were published as Exhibits B and D, Circular DV-955, report of Committee on Specifications for Materials, Chicago, May 29, 1939. Specifications M-910-39 for renovated journal-box packing were approved, submitted to letter ballot and adopted by a majority vote of the members and is now in effect. Specifications M-904-39: renovated car oil, by action of the General Committee in New York on June 27, 1939, was deleted from the 1939 report of the Specifications Committee and was referred back to the committee for further study and analysis.

### 1940 Survey of Renovated Car Oils

The action of the General Committee was transmitted to the members of the committees by the secretary under date of July 13, 1939, and was referred to your joint sub-committee by action of the Lubrication Committee on December 13, 1939, and of the Specifications Committee on January 17, 1940, with instructions to make a survey of the renovated car oils actually used by the roads having membership on the General Committee. Inasmuch as the 1939 survey had included renovated car oils from a number of roads represented on the General Committee, and also having membership on the Specifications Committee, the 1940 survey was limited to a group of eight roads, the Canadian Pacific; Chesapeake & Ohio; Chicago & North Western; Delaware, Lackawanna & Western; Norfolk & Western; Reading; Southern Pacific, and Union Pacific.

All except the Southern Pacific* furnished information covering the method of renovation, and source and make-up of sample submitted. Samples of the straight renovated oil or blends of renovated and new car oils in the proportions actually used by the railroad were secured and distributed to the A. T. & S. F., C. B. & Q., Mo. Pac. and N. Y. C. laboratories for check analysis. In each case, the railroad furnishing the sample also made check analysis of a retained portion of the sample in their own laboratory. All laboratories made check of the items and by the methods to be considered for the 1940 revision of specifications M-1904.

The detailed result of this 1940 survey tabulating the check analyses of the several railroad laboratories of the duplicate samples of the several renovated car oils or blends to be studied are attached as Exhibits D to L inclusive.

(These exhibits are not included in this abstract.)

### Proposed Revision of Specifications M-904-40

Attached hereto as Exhibit M is a draft of the revision of the renovated-oil specification suggested by your joint sub-committee for report to the association this year with recommendation for submission by letter ballot as specifications M-904-40: adopted 1928, revised, 1930, 1936, and 1940.

(This exhibit is not included in this abstract.)

### Specifications M-910: Renovated Journal-Box Packing

Your joint sub-committee has carried out your instructions to consider the matter of placing some arithmetical limitation on the percentage of "short ends" permissible in renovated journal-box packing as suggested by G. W. Ditmore, a former chairman of the Lubrication Committee, in his communication of March 4th to the secretary, and referred to the committees with his file ST-10-910 of March 8, 1940.

The suggestion of the joint sub-committee for a revision of specifications M-910 to meet Mr. Ditmore's objections as made in the preliminary draft of the 1940 annual report dated April 4, 1940, was approved at the meeting of the Lubrication Committee on April 18th, but, after consideration of reports of proof checks of method and determination of the actual percentage of "short ends" in renovated packings by several members of the Specifications Committee, as suggested in the chairman's letter of April 4th, to the memberships, the revision of specifications M-910 to include the proposed limit for "short ends" was not approved and will not, therefore, be recommended to the association membership.

The report as a whole was signed by J. R. Jackson (chairman), engineer of tests, Mo. Pac.; P. Maddox, superintendent car department, C. & O.; A. J. Pichetto, general airbrake engineer, Illinois Central; L. B. Jones, engineer of tests, Pennsylvania; W. G. Aten, mechanical inspector in charge of lubricating matters, C. B. & Q.; J. Mattise, general air-brake instructor, C. & N. W., and J. W. Hergenhan, assistant engineer, test department, N. Y. C.

In presenting the report, Chairman Jackson called the attention of the members to the fact that the proposed revision of Specification M904-40, Exhibit "M," in the report, had been withdrawn by the committee for further study.

## Report on Wheels

During the year there have been two meetings of the Wheel Committee in addition to meetings held by sub-committees detailed on various special subjects. As a result of the year's work your committee submits the following report:

### Cast Iron Wheels

In the 1939 Report of the Wheel Committee, Circular DV-959, a revision of the Cast Iron Wheel Specification M-403-39 was presented for consideration, the revised section of the specifications being attached as Appendix A. (Not included in the present abstract of the committee report.) It is now the unanimous opinion of the Wheel Committee that these revised specifications be advanced to standard with modifications as indicated below:

### Sec. I. Manufacture

*Par. 4. Marking*—Revise to read: "All wheels shall be marked and numbered consecutively in accordance with instructions issued by the purchaser.

"All wheels shall bear the initials of the purchaser, weight of wheel, *serial number, tape indicating numerals,* and month, day

* The S. P. reported that they do not use their reclaimed car oil in making up journal box packing, therefore did not submit sample.

and year when made cast on the back of the plate as shown in *Fig. 4.* All wheels shall have the name of the manufacturer and place cast on the front of the plate. Wheel numbers once rejected shall remain unfilled. All wheels conforming to requirements of these specifications shall have plainly marked on the front of plate 'A.A.R. *1940*'."

In the foregoing revision, provision is made for applying the purchaser's serial number and the indicating tape numerals on the back of the plate. In the original design of the bracketed type, single plate wheel, this could not be done on account of the length of the brackets. The manufacturers have shortened the brackets and it is now possible to add this marking to the back of the plate.

### Sec. III. Design, Dimensions and Weights

*Par. 6.*—Identify Par. (d) as Par. (e) and insert new Par. (d) to read as follows: *All ground wheels shall be stenciled on front and back of plate with tape size as measured after grinding for use in mating wheels for mounting. Cast numerals shall be chipped to represent "as cast" tape size.*

In Tables I, II and III, change maximum weight from 825 lb. to *850* lbs. In Table I, change minimum weight from 815 lb. to *840* lb. The reason for this recommended change in weights is, the wheels as now manufactured are weighing around 850 lb.

### Sec. V. Inspection and Rejection

*Par. 10.*—Insert new paragraph designated as (e-4) to read as follows: *Wheels checked for out-of-round, where there is more than 1/32 in. space between ring gage and tread may be ground to conform to the specifications. Such wheels shall not be reduced more than two tape sizes and the taper 1 in 20 shall be maintained,* and then change present paragraph (e-4) to (e-5).

## Bracketed Cored Hub Wheels

In the committee's 1938 report, reference was made to authority having been granted the Association of Manufacturers of Chilled Car Wheels to manufacture 10,695 lb. bracketed type, cored hub wheels for use on cars of 100,000-lb. capacity.

In conformance with the above authority the cast iron wheel manufacturers have made 3,200 wheels, distributed as follows: 800—under lightweight welded cars for the Pullman-Standard Car Manufacturing Company; 800—under 50-ton cars for the C. B. & Q.; 800—under 40-ton refrigerator cars for the General American Transportation Corporation; 800—under lightweight cars for Pullman-Standard.

There still remain unfilled on this authority for 10,000 wheels, 6,800 bracketed-type, cored-hub wheels of 695-lb. weight.

The Association of Manufacturers of Chilled Car Wheels requests that it be permitted to manufacture the remaining 6,800 wheels on this authority in the bracketed, cored hub type of any standard weight. This request is made that more general information may be obtained from this type of wheel when applied to various classes of service.

Your committee is favorable to this request, but if granted, it should be with the understanding that the manufacturers cast immediately under the AAR-X in clearly discernible letters the words "cored-hub." This requirement is recommended in order to readily identify the cored hub wheels and thus simplify the handling of such wheels in Interchange. These wheels shall conform to the requirements under which the authority was originally granted.

## Cored Hub—Axle Strength

In discussing cast iron wheels with cored hubs in the 1938 report, mention was made of two conditions that might react unsatisfactorily to the use of this design, namely, the effect the cored openings in the hub surface might have upon obtaining a smoothly-machined surface in the bore of the wheel and the effect on the unsupported section of the hub might have upon te strength of the axle.

It has been reported that no serious difficulties have been encountered in boring the cored-hub wheels, but information is still lacking in regard to the effect the cored hub may have upon the strength of the axle. The Association of Manufacturers of Chilled Car Wheels advise it has a program of laboratory tests under way which tests are of a preliminary nature, but designed to develop information along the line of axle strength. It is anticipated that these preliminary tests will be supplemented with other laboratory tests using full size axles.

## Multiple-Wear Wrought Steel Wheels

Referred to in and appended to the 1939 report was a Tentative Specification for Heat-Treated Multiple-Wear Wrought Carbon Steel Wheels for Locomotives, Locomotive Tenders and Passenger Cars. The membership has had the opportunity to apply the specification throughout the year and while it has been closely followed by some roads, others, due to the specifications not being published in the Manual of Standards, have overlooked it.

So far, no criticism has been registered against this specification. It is the opinion of your committee that under Sec. II—Chemical Properties and Tests—Par. 5—the maximum carbon content in Class-C wheels be revised from 0.80 to to *0.77 per cent* and under Sec. II—Par. 7 (b) a maximum hardness be established for Class-C wheels. This maximum hardness to be *363 BHN.*

With the above mentioned revisions it is the recommendation of your committee that the tentative specifications for heat-treated multiple-wear wrought carbon steel wheels for locomotives, locomotive tenders and passenger cars be submitted to letter ballot for advancement to standard practice. These specifications revised in accordance with the above are reprinted as Appendix B (not included in this abstract of the committee report).

Multiple-wear wrought steel wheel specifications M-107-37 and the tentative specifications covering multiple-wear wrought carbon steel wheels, in the section referring to "Scope," limits the application of the specifications to 38-in. diameter wheels. The use of wrought steel wheels in the process of locomotive development has created a demand for wrought steel wheels exceeding the present 38-in. diameter limit and recommendations have been made that the item "Scope" be revised at this time. At the time this report was prepared the committee had not received suggestions from the Locomotive Construction Committee as to what its wheel requirements may be and it was considered that revision of the "Scope" section of the specifications and associated items be deferred for consideration by the Wheel Committee during the coming year.

## Shelling of Wrought Steel Wheels

The shelling of wrought steel wheels and tires represents a condition that is most destructive to the wheel and tire material. The shelled condition not only is objectionable from the standpoint of riding qualities, but the tendency of this condition to penetrate deeply into the material makes it especially destructive to the potential service of the wheel or tire where it occurs. Various thories as to the cause of tread material shelling have been advanced. The generally accepted theory is discussed in a recent booklet prepared by the Technical Board of Wrought Steel Wheel Industry. While the theory upon which this booklet is based is more or less technical the author in dealing with the subject has avoided as much as possible the technical side of the subject and treated it in such a manner as to be readily comprehended without the reader having to delve into the mathematics involved. As the subject treated in this booklet is so closely related to one of the major problems in wheel and tire service your committee requested the privilege of making the contents a portion of this year's report, available as Appendix C (not included in this abstract of the committee report).

[This discussion of the shelling of wrought steel wheels, prepared by the Technical Board of the Wrought Steel Wheel Industry and presented as Appendix C, is an extension of notes included in the 1939 annual report. It is a comprehensive and easily followed analysis of conditions which lead to shelling and methods necessary for its prevention. The wheel is studied as an engineering structure and an examination made of (1) stresses under various load conditions, (2) the metal strength and (3) the application of (1) and (2) to the selection of proper wheel types for various service requirements. Appendix C describes methods of computing tread stresses, discusses the mechanical properties of wheel steel, and the effect of rail and wheel tread contours on maximum shear stress. It concludes with the calculations necessary in developing a series of charts

giving surface stresses in compression and maximum shear stresses for varying wheel loads and wheel diameters.—Editor.]

### Cast Steel and Spun Steel Wheels

The status of the cast steel wheel industry is somewhat uncertain and while there are a number of cast steel wheels of the one-wear type in service, information reaching your committee is to the effect that neither the one-wear nor the multiple-wear wheels are, at the present time, in production.

The spun steel wheel industry is still actively engaged in efforts to produce a multiple-wear wheel capable of meeting exacting service conditions. In line with this policy the manufacturers have placed small groups of spun wheels under conditions where their service properties can be best developed and encouraging results are reported.

It has been suggested that attention be given to a revision of interpretations under Rule 98 referring particularly to answers to Questions 5 and 6 under this rule. Your committee recommends that under the first line of answer to Question 5 the words "one-wear wrought steel" be omitted and the "or" inserted between the words "cast iron" and "cast steel." With this change the committee sees no occasion for any revision of answer to Question 6.

### Cast Steel Wheel—Second-Hand Value

It has been brought to the attention of the committee that railroads handling cars equipped with one-wear cast steel wheels are coming in possession of second-hand wheels of this class with little or no opportunity for disposing of them. It appears that the one-wear cast steel wheel is no longer produced and its use is being discontinued by the railroads that formerly patronized it, it has also been stated that some of the railroads that formerly used one-wear cast steel wheels are substituting cast iron wheels and removing the cast steel wheel stenciling from the cars, thus making the cast iron wheel standard to the car. This practice is further limiting the opportunity for the disposal of accumulated second-hand cast steel wheels.

It is apparent that the chance for disposal of second-hand cast steel wheels accumulated in interchange is being more and more limited and your committee recommends that some protection should be afforded the railroads coming in possession of these wheels, through a revision of the second-hand value of one-wear cast steel wheels, making their values comparable with second-hand cast iron wheels of the same capacity, then revising the rules to permit one-wear cast steel wheels to be substituted for cast iron wheels at the second-hand value of cast iron wheels.

In order to better meet more exacting service conditions careful consideration is being given to materials and designs in the construction of car equipment which includes both wheels and axles. In dealing with the question of wheels and axles another factor that is as equally important as material or design, is the manner in which these two units are combined, or the wheel-shop practices followed in mounting.

The unsatisfactory manner in which some wheels and axles have been mounted can be readily observed in practically any active wheel shop by noting the condition of wheel fits on the axles and the bore of wheels as disclosed when they are dismounted in connection with wheel-shop processes.

Again, your committee wishes to emphasize the importance of providing adequate wheel-shop machinery and then demanding closer observance of methods that will produce a greater degree of refinement in the preparation of wheels and axles for mounting.

The report was signed by H. W. Coddington (chairman), chief chemical and test engineer, N. & W.; D. Wood (vice-chairman), engineer tests, Sou. Pac.; E. E. Chapman, mechanical assistant, A. T. & S. Fe; W. R. Hedeman, engineer of tests, B. & O.; J. Matthes, chief car inspector, Wabash; A. M. Johnsen, engineer tests, Pullman Company; E. C. Hardy, assistant engineer, N. Y. C.; A. G. Hoppe, assistant mechanical engineer, C. M. St. P. & P.; H. H. Haupt, general superintendent motive power, Penn., and C. B. Bryant, engineer of tests, Southern.

### Discussion

Following the presentation of the report by Chairman Coddington, F. J. Jumper, general mechanical engineer, Union Pacific, read a prepared discussion in which he described Union Pacific experience with thermal cracking or checking and shelling of wrought-steel wheels under the exceptionally severe conditions of modern high-speed passenger-train service. He attributed the difficulty largely to overheating of the wheels in heavy brake applications and the subsequent sudden cooling on the cold rails or by the application of snow or water. These difficulties have now been largely overcome by the use of heat-treated steel wheels with a carbon content ranging between .57 and .67, and a minimum Brinell hardness of 277. Mr. Jumper said that important factors in satisfactory wheel service and life include ground treads, brake rigging of proper design, square truck frames and journal boxes designed for free vertical movement without binding.

C. T. Ripley, chief engineer, Technical Board, Wrought-Steel Wheel Industry, complimented the committee on its report and said that the carrying out of its recommendations will promote safety, benefit shippers and save the railroads money. Both wheel manufacturers and the railroads must cooperate in effecting improvements necessary to meet the more difficult operating conditions attendant upon high speeds. Mr. Ripley said that research for wheel improvements must be continuous and that, on account of the increased severity of the service, the day has passed when any single steel wheel can be expected to meet satisfactorily the requirements in every class of service. Wheels must be selected with regard to the types best adapted for particular conditions, as pointed out in the committee's report.

Mr. Ripley paid tribute to the general ability, intelligence and loyalty of men employed in wheel shops and suggested that, when unsatisfactory wheel and axle work is discovered, it is usually due to the lack of proper shop equipment. In other words, with machining tolerances of .005 in. now being demanded and attained in wheel-shop work, micrometer tools and calipers are essential, and desired results cannot be expected even with the most competent and experienced wheel-shop forces if they are compelled to work with obsolete worn-out shop tools.

F. H. Hardin, president, Association of Manufacturers of Chilled Car Wheels, endorsed Mr. Ripley's comment regarding the large amount of intensive and thoroughly competent work which the Wheel Committee has incorporated in its report this year, particularly as relates to those recommendations which will assure increased reliability and longer life of car wheels. Mr. Hardin said that, owing to substantially higher freight-train speeds and the increased severity of operating requirements, carefully selected materials and fine workmanship are just as essential in wheel and axle assemblies in freight-car trucks as for those used in passenger service. Mr. Hardin also stressed the need for further improvements in wheel-shop practice and said that the railroads are cooperating fully with his association in securing improved service from chilled-iron car wheels.

There was some further discussion of the desired minimum carbon content in steel wheels used for high-speed passenger service and also the method of heat treating necessary to produce the best results.

*The report was accepted and necessary items referred to letter ballot.*

## Report on Brakes and Brake Equipment

Since the last annual report there have been two meetings of the full committee and a number of sub-committee meetings covering investigation of various items under consideration, many of which are still incomplete, and we submit the following for your consideration at this time.

### Air Hose Couplings

The question of suitable gages for checking used couplings, methods of reclaiming or servicing hose couplings, has been before us for some considerable time and while the solution may have appeared simple at first glance, it is not to be so readily solved. Much time has already been given it with considerable progress, and we hope to have definite recommendations to submit in the very near future.

In our report last year we promised you that our recommendations would be forthcoming in the very near future for a No.

3 or No. 18 brake beam, but we regret to say that we have not yet completed all the details in connection with this design because many such details now seem to involve the present standard No. 15 beam in which interchangeability and further standardization of certain parts that may be used for both the No. 15 and No. 18 beams seems possible, and, of course, desirable, and some further study is necessary.

On numerous occasions your committee has been pressed for its approval of reversible struts of one kind and another comprising two or more parts. We have examined many types and designs of such struts over a period of years and we are in accord that they are undesirable in one or more features they embody, and that any merit they may possess seems entirely outweighed by the disadvantages introduced by their use. We therefore do not approve of any reversible struts employing two or more component parts.

### Modification of Freight Retaining Valve

The question of redesigning the freight retaining valve in order to provide additional protection and variable control of brake cylinder pressures was acted upon by a sub-committee and a report submitted at our last regular meeting, which was accepted in general. However, a difference of opinion prevailed as to the most desirable size of the orifice openings and rates of blow down for the various grade operations encountered in nation-wide operation. It seems necessary to confer further with the manufacturers and to also determine by individual observation under the various operating conditions what dimensions and rates may be most satisfactory.

Applications of the molded rubber sleeve and the latest design of wasp excluder recommended in our report last year have been made but we are not yet in a position to make a definite statement as to their entire satisfaction. To date we have no unfavorable comments in respect to them and the indications are that they provide the protection desired.

### Cleaning, Testing and Lubrication of AB Valves

You will recall that from previous inspections of experimental AB brake equipment in service on Pennsylvania and Santa Fe cars it was decided at the last inspection in 1937 to equip a number of these cars with improved design of brake-pipe strainer in view of the fact that previous tests of these strainers seemed to indicate there was a possibility that very minute particles of foreign matter may in time filter through the strainers and get into the valves. The manufacturers had previously realized this and were at that time prepared to supply the improved design. Your committee was also convinced they were superior in every way, but to definitely determine as to whether or not they would be entirely satisfactory throughout at least a three year period in actual service, they were applied to these cars. These strainers have now been in service three years and arrangements are under way to make the necessary inspection and tests similar to those previously made.

### Reclaimed or Reworked Brake Beams

In the reclamation of brake beams it has been the practice on some roads to apply hardened bushings to the pin hole in the brake beam strut. It is our recommendation that this practice is only satisfactory with existing struts providing there will be not less than 3/16-in. wall thickness at any point of the boss surrounding the pin holes after the holes are drilled out concentric with the original pin hole center to 1½-in. diameter and that the bushings are a tight pressed fit.

With respect to the new struts for the standard No. 15 beams, it is our recommendation that the strut dimensions given on Page 91 of Section E of the A. A. R. Manual be revised to show sufficient material surrounding the pin holes to provide ample strength at this area when the pin holes are drilled to 1½-in. diameter.

### Stencilling of Cleaning Dates for AB Brakes

Due to the extended service period of AB brakes over those of the "K" equipment your committee is in accord with the Arbitration Committee's opinion that the stencilling of cleaning dates may not always remain legible throughout the allotted service period where the stencil is applied as shown on Page 123 of Rule 60, Code of Interchange Rules. We see no objection to the stencilling being applied on the side of the car at, or as near, the center of the car as practicable, or any other location that will insure it being legible at all times.

We are also in accord with the suggestion in reference to deleting the last sentence in Paragraph (h) of Interchange Rule 60.

### Lubrication of Air Brakes

Supplementary to our recommendation last year in this connection in which reference was made to the need for approved lubricants for air brake valves and cylinders, your committee is convinced it is imperative that the AB brakes be lubricated only with tested and approved lubricants in order to insure satisfactory performance throughout the longest possible service period, and the following specifications for oil for air brake valves, graphite for air brake valves, and grease for air brake cylinders are recommended for your approval as the approved and standard lubricants to be used. [These specifications were included in this report.—Editor]

### Changes in Construction of AB Brakes

Certain minor changes have been introduced in the AB equipment since it was originally introduced into service that have very definitely improved their performance and service life. The items affected are:

Quick-action chamber-charging choke, piece No. 506277; brake-pipe strainer, piece No. 502904; emergency piston spring, piece No. 501006; Reservoir release-valve end plate, piece No. 54963 and, wasp excluder barrier in the quick-service vent passage, piece No. CV-276.

It is our recommendation that improved parts covered by the above mentioned piece numbers be substituted for those of previous designs and piece numbers as AB valves are given periodical attention in accordance with Interchange Rule 60.

The report was signed by W. H. Clegg (chairman), general superintendent motive power and car equipment, Grand Trunk Western; R. E. Baker (vice-chairman), general air brake inspector, Boston & Maine; T. L. Burton, air brake engineer, New York Central; C. H. Rawlings, superintendent of air brakes, D. & R. G. W.; L. S. Ayer, general air brake inspector, Sou. Pac.; R. J. Watters, general air brake inspector, Nor. Pac.; J. A. Burke, supervisor air brakes, A. T. & S. F.; Otto Swan, air brake instructor, Union Pacific; J. P. Lantelme, general foreman, Pennsylvania; J. Mattise, general air brake instructor, C. & N. W., and R. E. Anderson, general air brake inspector, C. & O.

In presenting the report, Chairman Clegg called attention to the oxidization test in the Oil Specifications, exhibit A, and to the Graphite Specifications. These, he said, should be referred to the Committee on Specifications and Tests for their approval.

The chairman of the committee was asked to explain what are the disadvantages of the two-part brake-beam strut, which the committee did not approve, and Mr. Clegg replied that the two-part reversible brake accumulates lost motion in service and results in the development of too much flexibility in the brake beam. T. L. Burton, a member of the committee, explained further that a strut between a compression and a tension member was partly in compression and partly in tension and that under such conditions, nothing but a solid member could fully retain its effectiveness.

*The report was accepted and referred to letter ballot.*

## Report on Couplers and Draft Gears

### Type E Couplers Breaking in Service

Acting upon information received that Type E couplers were breaking in service, an investigation was made of this condition by the members of the committee and also by the Mechanical Committee of the Coupler Manufacturers. An examination was made of 244 broken couplers, 221 of which were cracked or broken through the front face and 162 had received a heavy impact on the guard arm.

The committee, through its analysis, is unable to assign car

design, coupler or attachment design, material or foundry practice as a factor in this problem. It has had no opportunity to investigate the service conditions under which these failures are occurring, but the face-breakage failures and broken-off guard arms are occurring in the transportation yards. The heavy impact on the guard arm is evidence that the speed at time of coupling is too great and that couplings are attempted with knuckles not fully opened. The correction lies in reducing speed to 2 m.p.h. at the time of coupling and insuring knuckle or knuckles being fully opened before coupling is attempted.

### Top Lock Lifter Link Hook of Type E. Coupler Straightening Out in Service

Under certain conditions of wear, the straightening of the top lock lifter link hook is possible. This condition was taken care of by a redesign of the top lock lifter link for the Type E coupler which has been approved by your committee and the change in design was put into effect, December, 1939.

### Train Partings of Standard Type E Couplers

During the year, it has come to the attention of your committee that some train partings have occurred between new cars built in 1936 and 1937 and equipped with standard Type E couplers. It has also been reported that standard Type E couplers have been found with bottom lock lift toggles missing and in an inverted position. In either case the coupler lock would be deprived of its anticreep feature. This condition was immediately brought to the attention of the Mechanical Committee of the Coupler Manufacturers, and a thorough investigation and study has been made of these conditions.

To eliminate these conditions, proposed changes in the several types of rotor levers and the toggle consist of a redesign on the basis that one end of the rotor lever in each case is provided with a jaw into which the toggle is fitted and retained definitely in this assembled position by means of a rivet. In the passenger Type No. 1 arrangement, the rotary lock lifter link is also riveted to the rotary lock lifter lever. The new design of rotor lever and toggle will be furnished completely assembled and riveted together. These proposed changes in the several bottom rotor levers and the toggle will affect the design of the present standard gages. The gages will therefore be changed in accordance with the changes affecting the above coupler parts.

Your committee at its meeting on February 19, 1940, at Cleveland, approved the above proposed changes in design of the bottom-rotary lock lifter and toggle and recommended that gages for properly checking this revised design be prepared and put into service for the Type E coupler. These changes became effective in the fitting of new couplers and for repair parts by all coupler manufacturers about June 1, 1940, and do not require any alteration in the uncoupling rods.

It is to be understood that to date very little trouble has been experienced from these toggles either missing from couplers in service or improperly applied on account of any wear that has thus far taken place. The improvements herein presented are for the purpose of correcting any conditions that may be encountered in the future and to improve the design of the E coupler mechanism.

### Type D Couplers Opening in Service

On May 13, 1938, Circular DV-935 was sent out to the membership calling attention to means for preventing separation of bottom-operated Type D couplers in passenger service by application of the No. 3 lock lift toggle. Since that time, this condition of trains parting with Type D couplers seems to be relieved in passenger service, but information has reached your committee that separations are occurring on top-operated Type D couplers in freight service. There are two conditions in freight service that may contribute largely to the opening of these Type D couplers. Indications are that the most prominent factor in these train partings is the use of push-down-type operating levers. The other condition responsible for top-operated Type D couplers coming open occurs in couplers to which the No. 3 top lock lifter has not been applied, or the No. 2 top lock lifter not built up on the anticreep to conform to the No. 3 design.

The committee again emphasizes the importance of maintaining the No. 3 type of lock lifter in top-operated and No. 3 toggles in bottom-operated Type D couplers in order to prevent train partings caused by couplers of this type opening in service.

### Types D and E Couplers—Fully Locked Position

The question has been raised as to the method of determining when Types D and E bottom-operated couplers are in the fully locked position.

In order to demonstrate this condition, a diagram was prepared to show the Types D and E couplers in the lock-set position and in the fully locked position. It will be noted that in the Type D coupler in fully locked position, the bottom of the lock extends slightly below the bottom of the coupler head, and the toggle is practically fully visible. In the Type E coupler in fully locked position, the bottom of the lock is approximately flush with the bottom of the head and the greater portion of the toggle is visible. (The diagram is not included in this abstract.)

### Reclamation of Draft Key and Knuckle Pins

The secretary has referred to this committee two items relative to reclamation mentioned in Circular D-VI-483. One of the topics in question relates to condemning draft keys. To date, the committee has insufficient information to establish definite condemning limits for wear for draft keys but proposes to do so during the coming year.

The other item referred to this committee is the method of straightening knuckle pins and the heat treatment necessary for reclaiming pins. This process is clearly prescribed in the A. A. R. Manual of Standards and Recommended Practice, Section C, Page 68, Item 4, Paragraph (b).

### Yoke Substitute for Odd-Length Gear Pockets

A study has been made toward the development of a horizontal key type coupler yoke that might be used as a substitute for the riveted type yoke or non-standard design of cast steel yoke. The type of yoke that appears to best meet this condition is a combination of cast steel head and forged yoke straps, as shown in diagrams submitted with this report. (The diagrams are not included in this abstract.)

The use of a yoke of this type would enable repairs to be made without having to carry in stock yokes of a variety of lengths. The cast steel heads can be carried in stock and straps of the proper dimensions riveted to the head. It is the opinion of your committee that this type of construction will facilitate repairs and the design is presented with the recommendation that the proposition be submitted to letter ballot.

### Specifications for Second-Hand Couplers

Included in the committee's annual report for 1937 were specifications for second-hand couplers. These specifications were adopted as recommended practice in 1937 and it is the recommendation of your committee that these specifications be advanced from recommended to standard practice. It is further recommended to the Arbitration Committee that Section 4 of the second-hand coupler specifications, prohibiting the painting of second-hand couplers, be made mandatory through the Interchange Rules.

The Arbitration Committee has recommended "that the requirement for coupler body to be steel stamped on the side of the lock chamber when it contains one or more reclaimed parts, be eliminated, for the reason that these parts may be removed within a short period of time and new parts applied. Furthermore, the rules require stamping on or adjacent to any welded portion of the coupler body, in which event many couplers thus carry two steel stampings."

The Arbitration Committee further states that it is inconsistent to place a requirement in the Interchange Rules to prohibit the painting of reclaimed or second-hand couplers when no such prohibition is provided for truck sides. These recommendations were carefully considered by your committee and it does not concur in them.

The present requirements were incorporated in the Rules to protect car owners and after reviewing the matter, your committee is of the opinion that no change should be made in these requirements to insure that second-hand couplers are properly

reclaimed and where coupler bodies are welded in the knuckle side wall that the work will be properly performed. There is no further requirement in regard to the welded detail parts that may be applied to couplers in repairs.

Insofar as prohibiting the painting of second-hand couplers, your committee believes that this is a proper requirement so that proper inspection may be made of the welding that has been done, and is consistent with the requirement for new couplers which are not permitted to be painted. Subsequent painting of the coupler by the car owner does not affect these specifications.

INTERCHANGE RULE 18—PARAGRAPH (c)

The Arbitration Committee has recommended that the limiting dimensions for cracks in the shaded area in the knuckle side wall which do not warrant removal of couplers from service be extended from 7½ in. to 10 in. in length and from 3 in. above and 3 in. below center line to 4 in. in both instances, measured on the surface of the coupler.

This recommendation was considered and approved by your committee for condemning limits for couplers in service. It is, however, not recommended to extend the present reclaiming limits as now provided for in the Rules for the reason that cracks of the magnitude proposed for condemning the coupler cannot be satisfactorily reclaimed on account design of the coupler head. In order to clear up another point, in regard to the measurement of the cracks, it is suggested that these cracks be measured on the surface of the coupler.

The following change in Rule 18, Par. (c) is suggested to cover this matter:

*Proposed Form*—Coupler bodies, Types D and E, with cracks in knuckle side wall back of knuckle tail shall not be removed from foreign cars, unless—

(1) Such crack extends beyond the shaded area shown in Fig. D, page 57 (*4 in.* above and *4 in.* below the horizontal center line of knuckle side wall and *10 in.* back of front edge of knuckle side wall). *These cracks shall be measured on the surface of the coupler.* When crack extends beyond the shaded area, the coupler body is condemned. (2) Section is broken out within this prescribed area whose greatest dimension exceeds three inches. (3) *Coupler bodies must not be reclaimed by welding if the crack extends more than 3 in. above and 3 in. below the horizontal center line of knuckle side wall; or 7½ in. back of front edge of knuckle side wall; or section is broken out whose greatest dimension exceeds 3 in.*

## Tight-Lock Coupler

During the year, trouble developed with tight-lock couplers parting in service. Your committee in cooperation with the Mechanical Committee of the Coupler Manufacturers made a thorough study and analysis to establish the cause.

It was found that these partings generally occurred during wet weather and it was difficult to reproduce the partings on the same couplers after they had occurred in service. The cause for parting was finally determined to be due to the secondary anti-creep being ineffective when there was a sudden impulse for the lock to lift particularly when the parts were wet or lubricated.

Changes were made in the contour of the secondary anti-creep ledge and the engaging toggle, and model and laboratory tests made to determine whether positive corrective action had been taken, followed by road tests in the New York Central yards at Cleveland, O., with the result that it was impossible to obtain undesired partings with couplers wet and lubricated. These tests were severe and several couplers other than tight-lock couplers were fractured during these tests. As a result of the analysis and tests conducted, Circular D.V.-977 was issued April 3, 1940, covering instructions for making adjustments to improve lock anti-creep to prevent parting in service.

Attention is directed to the necessity of making the adjustments to the tight-lock couplers in service or in stock on the railroads at the earliest practicable date, and discontinue the use of an "S" hook, or bolt, through the telltale hole in the toggle, as the use of such hooks or bolts prevents operation of the coupler by means of the uncoupling rod and is a violation of the U. S. Safety Appliance Rules.

The changes involved in the coupler consists of: (A) Change in contour of the secondary anti-creep ledge in the bar to provide for positive engagement of the anti-creep shoulder on the toggle. (B) Redesign of the toggle to improve the angle of and enlarge the secondary anti-creep shoulder. (C) Adjustment in the primary anti-creep shoulder at the front of the lock to improve the engagement of the primary anti-creep shoulder at the front of the bar, and also to assist the positive engagement of the secondary anti-creep.

These changes were authorized by your committee as it was essential to take immediate action and your approval of these changes is respectfully requested as it is not considered necessary to submit them to letter ballot.

## Specifications for Tight-Lock Couplers

Specifications for the purchase and acceptance of A. A. R. tight-lock couplers and coupler parts, radial connections, yokes, and attachment parts were appended to this report. It is recommended that these specifications be submitted to the Committee on Specifications for Materials for approval and then included in the letter ballot for adoption as recommended practice.

## Protection of Coupler Operating Mechanism

It has been brought to the attention of your committee that some undesired uncoupling of passenger cars in service has been experienced due to objects striking the uncoupling rod handle or the bail to the uncoupling mechanism, and considerable study has been given to determine the best method to prevent this.

Jointly with the Mechanical Committee of the Coupler Manufacturers, your committee is working on a means for locking the operating lever and also a means for locking the bail to the uncoupling mechanism to the end that if anything strikes either the operating lever handle or the bail in transit uncoupling will not occur.

The locking of the uncoupling rod at each side of the car and of the bail to the uncoupling mechanism presents difficulty in design for which a solution has not yet been found. It is confidently expected that if the coupler operating mechanism is confined to one side of the end of the car, a satisfactory locking device could be readily developed.

While a number of designs have been evolved to accomplish the desired result, no conclusion has been reached to warrant your committee making any definite recommendation at this time. The committee solicits suggestions from the membership and will appreciate it if the representative members of the individual railroads will give to the committee the benefit of any recommendation they may have to make to overcome this reported trouble.

An expression from the membership is desired in regard to operating the coupler from one side of the car only, similar to freight cars. If the type of rod operating from one side of the car is satisfactory, your committee believes that an efficient locking device can be presented.

## Report of Sub-Committee on Draft Gears

*Approved Draft Gears:* During the past year a conditional certificate of approval was issued for the Waugh-Clark 150-B draft gear. This brings to twelve the total number of draft gears approved to date, two of which are conditional approvals.

Attention is again called to the fact that conditional approvals are good for two years only, at the end of which time the gear may be advanced to fully approved status provided the service performance has been satisfactory. However, if the manufacturer involved already has an approved gear designed for the same pocket dimensions as the gear newly advanced to approved status, one of these gears must be withdrawn and placed in the non-approved classification.

Several changes of minor character have been made in the official drawings identifying the various approved draft gears during the past year.

*Check Tests of Approved Draft Gears:* As a result of the check tests of approved draft gears, which were described in last year's report, a complete new approval test of one draft gear and a partial retest of another approved gear have been required. If these gears do not meet these tests, or if the manufacturers fail to submit the gears for retest within a reasonable time, existing certificates of approval will be withdrawn. The attention of all manufacturers was directed to the specific details wherein the gears submitted to check tests were below requirements. Car owners who have applied conditional approved draft gears will

not be required to remove such gears from service if the approval status of gear is changed.

Since the first series of check tests showed that some new gears did not fully meet specification requirements, authority has been obtained to conduct another series of check tests within the present calendar year.

*Draft Gears for Passenger Service*: The committee submitted last year for comments and criticism proposed specifications for draft gears for passenger service. Since no comments were received, the secretary, under date of March 20th of this year, issued a circular letter to the members urging that comments or criticism be offered. Up to date of preparation of this report replies have been received from a total of thirty-four railroads.

There appears to be a strong feeling that any attempt to fix more or less arbitrary standards for passenger equipment draft gears at this time is somewhat premature, inasmuch as entirely new designs of gears are being introduced. Therefore, your committee has decided to make no recommendation for the present.

*New York Central Recoil Tests:* Several times during past years this committee has recommended that road tests be conducted by the association for the purpose of determining the effect of draft gear recoil in long freight trains. Present specifications for approved draft gears for freight service include no limit on percentage of recoil for the reason that no generally acceptable evidence exists to show what maximum percentage of recoil ought to be permitted under present day operating conditions.

During the past year the New York Central undertook to conduct such tests, and they were witnessed by the sub-committee. Two similar 100-car trains were used, one of which was equipped throughout with relatively high recoil gears, and the other with relatively low recoil gears. Both gears were approved types. Use of the brakes was limited to service applications.

The results of these tests were not conclusive insofar as the effects of recoil were concerned; however, some interesting facts were disclosed and permission has been obtained to include as Appendix "A" of this report a condensed summary of the New York Central report for the information of members of the Association.

[The test conclusions stated: "No excessive shocks were produced, with the result that practically no difference in handling was observed between the two trains under the conditions of the test. Neither of the two types of draft gears tested gave any indication of any action which might be considered as prejudicial to the use of the gears in regular service. The fact that the highest value lading block to tip over during these tests was only 65 per cent g. (representing the acceleration in per cent of gravity required to tip over the block) indicates that the maximum force exerted on the draft gear of any car was approximately 29,000 lb. Since this is less than the initial compression under which both types of gears are assembled, this leads to the conclusion that the forces set up in this train were not sufficient to cause the draft gears to function in such a manner as to make it possible for them to exert any recoil."—Editor]

The report was signed by R. L. Kleine (chairman), assistant chief motive power-car, Pennsylvania; H. W. Coddington (vice-chairman), chief chemical and test engineer, N. & W.; E. E. Root, chief motive power, D. L. & W.; L. P. Michael, chief mechanical engineer, C. & N. W.; J. P. Morris, mechanical superintendent, A. T. & S. F., and H. W. Faus (chairman, Sub-Committee on Draft Gears), engineer motive power, N. Y. C.

H. W. Gilbert, National Malleable & Steel Castings Company, stated that the coupler manufacturers have endeavored to cooperate in improving coupler design and service, and that their efforts in this direction can be rendered more effective if the railroads will supply the manufacturers Mechanical Committee, of which he is chairman, with full information regarding all coupler defects as they are developed. The Mechanical Committee must have representative samples which will illustrate conditions in order that proper corrections and improvements in design may be effected.

P. P. Barthelemy, master car builder, Great Northern, referred to the drawing of the cast-steel head used with the A. A. R. wrought-iron yokes and raised the question if the holding power of the rivets should be supplemented by welding the yoke ends to the coupler head. Chairman Kleine replied that this is not considered necessary, since the rivets are in double shear.

R. G. Henley, superintendent motive power, N. & W., suggested the use of a filler ahead of the yoke to prevent couplers from drooping and raised the question if the coupler should not be designed for satisfactory coupling at speeds up to 4 m. p. h. instead of 2, as specified in the committee report, inasmuch as draft gears are designed to meet the higher speed requirement. He expressed appreciation for the committee's action in extending the condemning limit for cracked side walls because a few railroads have been taking advantage of this rule to remove couplers which should not be removed. Mr. Henley said that a record of coupler breakages indicates that 95 per cent of the damage is done in hump-yard switching.

Chairman Kleine replied that the yoke head, coupler butt and key are designed with close tolerances so as to reduce slack and prevent the coupler from drooping. While car impact speeds up to 2 m. p. h. are recommended for satisfactory coupler closure, Mr. Kleine said that couplers will not necessarily fail when striking a speed up to 4 m. p. h., as a substantial factor of safety is included in the design. He maintained that the question of speed in hump-yard switching is a matter of regulation and may be reduced to 2 m. p. h. at the moment of impact without slowing up yard operation.

This opinion was challenged by D. S. Ellis, chief mechanical officer, C. & O., and by K. F. Nystrom, mechanical assistant to the operating vice-president, C. M. St. P. & P., and supported by E. B. Hall, general superintendent of motive power, C. & N. W., who said that the hump-yard operation would not necessarily be slowed up, since two cars are seldom switched one immediately after the other down the same track.

Mr. Nystrom suggested that a study be made to determine the impact strength of cast steel at sub-zero temperatures as a possible cause of coupler failures and Chairman Kleine said, in closing, that this and other questions developed in the discussion will be given further consideration by the committee.

*The report was accepted and referred to letter ballot.*

# Report on Tank Cars

During the past year the committee considered a total of 413 dockets and applications for approval of designs as follows:

Two hundred and forty-seven covered designs, materials and construction of 3,829 new shipping containers, for application to new cars or for replacement on existing cars.

Three applications covered eleven multiple unit cars to be used for the transportation of fifteen Class I. C. C.-106-A-500 one-ton containers each.

One application covered two new underframes and trucks on which would be mounted existing tank car tanks.

One hundred and forty-one applications covered alterations in, additions to or conversions and reconditioning of 2,751 existing tank cars or shipping containers.

Twenty-one applications requested approval of tank car appurtenance designs, without reference to specific cars.

Hearings are now tentatively set for an early date on the proposed general revision of the Interstate Commerce Commission Specifications For Tanks To Be Mounted On Or To Form Part Of A Car, indicated by the Committee's report of May 29, 1939 to have been previously submitted to the I. C. C.

## Specifications for Fusion Welded Tank Car Tanks

At public hearings before the Interstate Commerce Commission, during September, 1934, your committee recommended the adoption of specifications, then presented, which would permit the construction of tank car tanks fabricated by means of fusion welding. Your committee, at the same time, recommended the use of tank car tanks so constructed for the transportation of articles classed as dangerous.

A general revision of the 1934 proposed fusion welded specifications has been formulated, to incorporate necessary modifications in line with changes in the art, and to harmonize the requirements for tank car tanks, as near as is practicable, to the requirements of other code authorities.

Every effort is being made by the committee to complete their review of these revised fusion welded specifications to permit of submission of same to the I. C. C. so as to receive consideration at hearings proposed to be held in the near future on general revision of the currently effective shipping container specifications covering riveted and forge welded tank car tanks.

Since the public hearings before the I. C. C. at Washington,

D. C., on September 5, 6 and 7, 1934, on the matter of fusion welded tank car tanks the commission has authorized the construction of a total of 1,074 tank car tanks, fabricated in conformity with the proposed specifications then submitted, and their use in experimental service trials transporting articles classed as dangerous by their Regulations.

To date certificates have been filed indicating that, of the cars so authorized to be equipped, 442 have been constructed and placed in service. Since last report no advices have been received of any of these cars having been involved in accidents.

Reports are regularly received covering conditions of all fusion welded tank car tanks authorized for experimental trials. In addition, these reports also supply service records. These reports indicate a satisfactory performance for the fusion welded tanks now in service after having traversed 10,113,311 miles, during 13,530 trips.

With a view to clarifying present standard definitions for tank cars your committee recommends submission to letter ballot proposed definitions for Class T tank car type cars and supplementary table as outlined by Appendix A. (Not included in the present abstract of the committee report.)

### Tank Car Safety Appliances

Appendix A of United States Safety Appliances Hand Book, covering safety appliances for tank cars, was last revised during 1920. Since that time there have been a number of changes necessitated by the demands of shippers and their customers. Since parties proposing the construction of tank cars are required to secure committee approval before placing same in service and as no requirements outlining details of the additional appliances required by these demands have been adopted and published for general use this has necessitated submission of such applications to the Committee on Safety Appliances. With a view of eliminating delays attendant upon such handling your committee is formulating a general revision of Appendix A, to be designated as Appendix B, outlining safety appliance requirements for tank cars constructed in the future. Proposed Appendix B after concurrence by all parties will be submitted to the voting members for adoption by letter ballot.

### Appendix A—Definitions and Designating Letters for Tank Cars

*Proposed Form*—Class T Tank Car Type, "TM"—Tank car for transporting oil, gasoline, or other liquids, including liquefied compressed gases, but not including acids. Consists of a riveted, fusion welded or forge welded tank mounted on car structure. Design of tank and appurtenances for these cars is dependent upon the lading to be transported. Tanks must be equipped with safety valves or safety vents. Unloading may be through bottom discharge or, if not so equipped, overhead.

"TA"—Tank car for acid service. Of same general design and construction as oil tanks except same must be equipped with safety vents and overhead unloading arrangement. Safety valves and bottom discharge is prohibited.

"TL"—Tank car of same general construction as "TA" car except that tank is lined with aluminum, nickel, rubber, tin, zinc, etc., (except glass) to resist corrosive action of lading or prevent its contamination.

"TG"—Tank car having one or more glasslined tanks for transporting mineral water, etc.

"TGB"—Tank car for transporting beverages, etc., having two cylindrical metal tanks (with or without lining), the loading and unloading devices for same being enclosed within, and protected by a cab located between the tanks.

"TMN"—A car of suitable design for transporting removable non-dangerous articles containers.

"TMU"—A car of suitable design, including cradles and anchorage, for use in transporting liquefied compressed gas ton-containers of Class I. C. C.-106-A series and cars of I. C. C.-107-A series for transporting compressed gases.

"TW"—A car equipped with one or more wooden tanks, or, one or more metal or wooden tubs. Such tank or tubs may be lined. Car is sometimes equipped with a roof.

*Note 1*—Where tanks, tubs or containers mounted on any of the preceding Tank Car Type Classes are insulated the letter "I" should be affixed to their applicable designating letters. For example, TAI, TGI, TGBI, etc.

The report was signed by G. S. Goodwin (chairman) mechanical engineer, C., R. I. & P.; F. A. Isaacson (vice-chairman), engineer car construction, A., T. & S. F.; A. G. Trumbull, chief mechanical engineer, C. & O.; B. M. Brown, assistant superintendent motive power, Sou Pac.; W. C. Lindner, chief car inspector, Penn.; A. E. Smith, vice-president, Union Tank Car Company; G. A. Young, head, School of Mechanical Engineering, Purdue University; F. Zeleny, engineer of tests, C., B. & Q.; W. C. Steffa, transportation manager, Sinclair Refining Company; R. T. Baldwin, secretary, The Chlorine Institute, Inc.; H. J. Gronemeyer, supervisor, car equipment, E. I. duPont de Nemours & Company, Inc.; and R. W. Thomas, manager, Philgas department, Phillips Petroleum Company.

*The report was accepted without discussion.*

## Report of Committee on Loading Rules

The annual report of the committee for 1940 embodies several changes in the present rules, as well as a number of new rules recommended by the shippers, all of which are of such importance as to merit very careful consideration.

During the past year we have again received the splendid cooperation of the shippers, as well as the member lines. The recommendations presented by the shippers have been very helpful to the committee in formulating new rules and modifying the present rules, where modification was deemed necessary to produce an economical, substantial and safer load. It is very gratifying to this committee to receive this excellent cooperation and support for the further betterment of loading practices and we, with the Association, desire to extend our sincere appreciation.

Experimentations with several new methods of load securement are in process and the results of the tests so far are very gratifying.

Two meetings have been held with the shippers during the past year, one with the lumber interests (creosoted pole shippers) in the south and one with the steel industries, both of which brought about a better understanding of the problems that confront the carrier and shipper.

The following changes and new rules are presented for your approval and adoption to become effective in supplement to the rules to be issued subsequent to the Annual Meeting.

### General Rules

#### Rule 10

Add new sentence to Section (c) to read: "Stakes may be placed either in or out of stake pockets on inside of gondola cars with sides 30 in. high or over, provided they rest on car floor and are securely wedged to car sides by lading."

*Reason:* To clarify the rule.

Add new sentence to Section (d) to read: "Boards, lengthwise of car, attached to stakes above top of car sides, must be nailed to inside of stakes."

*Reason:* To eliminate the possibility of boards becoming detached in transit.

Change Section (f) to read: "Such fastenings need not be used when top tier of H and I beams with flanges 6 in. wide or more are loaded flatwise, and lower edges of flanges extend at least 4 in. below top of car sides and confined inside the flanges of beams underneath."

*Reason:* Greater safety.

#### Rule 11

To read as follows: "Substitution for High Tension Wire and Bands.—Where high tension bands or high tension wires are specified in the detailed rules, they may be substituted for each other, if of equal load strength, provided all the other items used to secure the load are equal in number and strength."

*Reason:* To serve as guidance.

#### Rule 14

Add new rule to read: "Nails. (See Figure 1-B.)"

*Reason:* To indicate the sizes of nails for the guidance of the shippers.

#### Rule 15

Change first paragraph Section (c) to read: "The substitu-

tion of high tension bands or high tension wires for rods, bolts or bands with threaded ends is permitted only when specified. When used they must have a percentage elongation in 6 in. from 5 to 16 per cent, inclusive.

*Reason:* Bands now used are generally hot rolled.

Change third paragraph Section (c) to read: "High tension bands or wires, encircling pile must be machine tensioned, sealed or twist tied, respectively, on top of load, when possible."

*Reason:* To indicate that it refers to machine tensioning.

Change fourth paragraph Section (c) to read: "Twist tie the ends of each wire to provide 85 per cent load strength. Seal each band with one double crimp or two single crimp seals, 85 per cent load strength of band, except otherwise specified."

*Reason:* To clarify the intent.

### Rule 16

Change Section (d) to read: "Authority must be procured for handling loads which measure more than 8 ft. from top of rail to center of load."

*Reason:* To provide that all loads exceeding this height must be handled as special loads.

### Rule 18

Change Section (a) to read: "The width of load, distance between bearing-pieces, and length of overhang must not exceed the dimensions shown in tables No. 3 to 35, inclusive. For loads of uniform width throughout length of load, the minimum width *W* is to apply. Authority must be procured for handling loads which measure more than 8 ft. from top of rail to center of load."

*Reason:* The following wording has been eliminated account being fully covered by General Rule 7, "for loads 12 ft. high or less, measured from top of rail to top of load. For loads over 12 ft. high from top of rail to top of load, the given width must be reduced 2 in. for each inch in height for that portion of load in excess of 12 ft." Last sentence has been added to indicate that all loads exceeding this height must be handled as special loads.

[The remainder of the report was devoted to the details of revisions made either to the drawings or the text accompanying the drawings in Figs. 3, 5, 6, 22, 27, 27-A, 29, 30, 31, 51, 51-A, 63, 63-A, 66, 69, 134, 135, 198 and 199-A. New figures 71-A, 84-B and 200-A were added, covering the loading of wire mesh in rolls, transite pipe and granite.—Editor]

The report was signed by W. B. Moir (chairman), chief car inspector, Pennsylvania; C. J. Nelson (vice-chairman), superintendent interchange, Chicago Car Interchange Bureau; R. H. Dyer, general car inspector, N. & W.; H. S. Keppelman, superintendent car department, Reading; T. W. Carr, superintendent rolling stock, P. & L. E.; A. H. Keys, district master car builder, B. & O.; H. H. Golden, supervisor A. A. R. Interchange and Accounting, L. & N.; H. T. DeVore, chief interchange inspector, Youngstown Car Inspection Association; H. J. Oliver, general car inspector, D. T. & I.; and F. G. Moody, master car builder, Nor. Pac.

In presenting this report, Chairman Moir said that a study of disarranged loads during the period between January 1 and May 1, 1940, indicated that 3,465 cars were shopped for readjustment of the load, 1,898 being due to yard switching and 1,367 to road haul, the estimated cost of labor and material for this work, estimated on an annual basis, being $37,825. This cost must be reduced by an organized campaign carried out with the same thoroughness as the safety program. Only about 50 per cent of the cases of load shifting are reported by the railroads, according to Chairman Moir, who expressed appreciation for the excellent cooperation secured from many shippers, especially in the handling of experimental test loads. J. McMullen, superintendent car department, Erie, said that this report is always important and must represent the result of intelligent research and complete cooperation between railroads and shipprs if desired results are to be obtained. He called attention to the use of high-tensile steel bands and wires as an important factor in modern loading; urged the closer observance of loading rules; stressed the importance of reporting all failures; urged closer supervision of loading practices by the transportation department, and said that the membership should cooperate more fully with the Loading Rules Committee, as all apparently do not realize the amount and importance of the work which it does in the interest of the railroads as a whole.

*The committee report was adopted.*

## Report on Car Construction

In the report for last year we stated that the full Car Construction Committee, in cooperation with the Freight-Car Design Committee of the American Railway Car Institute, had undertaken an economic study of lightweight box-car designs in line with program of 1932, items (a) to (f) inclusive, Appendix A to Circular No. D. V.—768 for that year. Further, that tentative designs for the following types of construction had been submitted for study and analysis: Lightened design in carbon-steel riveted construction; combination of carbon-steel riveted and welded construction; alloy steel with combination of welding and riveting; alloy steel, largely of welded construction.

This part of the work has been completed and last December your committee submitted to the A. R. C. I. a detailed comparative tabulation of design characteristics, weights and other data for the above types of construction and the A. A. R. standard steel-sheathed large size box car of 1937 of carbon-steel riveted design. This tabulation of characteristics was based largely on the designs tentatively proposed by the A. R. C. I. who were advised that your committee would be glad to have this undertaking progressed on the following basis:

(1) Prepare a design (or designs) of an improved steel-sheathed box car which the A. R. C. I. Committee would recommend for quantity construction as might be required.

(2) Strength, with corresponding anticipated service life, to be equivalent to that of the present A. A. R. standard car of enlarged dimensions as submitted in 1937, Appendix A to Circular DV-920.

(3) General dimensions to be same as for car under Item (2).

(4) The base design (or designs) to have doors and fixtures, roofs and ends of types as shown on Plate 1500, Appendix A to A. A. R. Circular DV-920, but of the latest designs. If desired, alternate design (or designs) may be submitted with these features similar in type to those illustrated on Plate 1501 of that Appendix.

(5) A more substantial floor structure than now shown by the present standard car drawings should be provided.

(6) Corner-post construction for the base design should be in accordance with an improved arrangement for which sketch was submitted.

At the time of our final meeting last March, this work had not advanced far enough for further joint conference, but it was then planned to call a special meeting of both committees previous to the annual meeting if progress made should warrant such action, in which case a supplementary statement would be prepared by the chairman for inclusion in the proceedings of the Mechanical Division for this year.

When submitting to the A. R. C. I. the above proposed steel sheathed box-car development program, your committee also requested the preparation of tentative designs of welded and riveted 50 and 70 tons nominal capacity hopper cars which the car institute would be in position to recommend for quantity production as required, it being the belief of your committee that such construction, either in high-tensile low-alloy or plain carbon steel, should provide the benefits of longer anticipated useful service life account elimination of rivet holes and corrosion in lap joints and other connections present in cars of riveted construction; also that some weight reduction should be obtained.

It was proposed to the car institute that the designs shown in Appendix A, Circular DV-836, report of Committee on Car Construction dated June, 1935, should form the basis for this work.

For both capacities of cars, over-all width and height of sides from top of rail, as indicated on these drawings, should be followed. Rail load limit capacity should be obtained with lading at 52 lb. per cu. ft. including 10-in. average heap, same as for the carbon-steel riveted designs.

The status of this work and subsequent procedure is the same as described above for the improved designs of steel-sheathed box cars.

### Freight Cars Ordered May 1, 1939, to May 1, 1940

The 1936 report of your committee presented the question of whether or not the majority of member roads desired the continuation of the work on A. A. R. design cars. The matter was discussed on the floor of the convention. Since that time your

committee has set forth in each annual report a statement of the freight cars ordered during the preceding year with sufficient characteristics of design to indicate the extent to which the member roads were following freight car A. A. R. standardization.

[At this point in the report, the committee inserted detailed tables showing a total of 46,936 new house-type and hopper cars ordered during the period of May 1, 1939, to May 1, 1940, of which 42,782 cars, or slightly over 91 per cent, were designed to "A. A. R. specifications throughout, or conforming thereto, including lightweight alloy steel to A. A. R. base dimensions, floating center sills, and inside dimensions to meet specific conditions." Of the remaining cars, 2,500 were A. A. R. design except for center-plate height; 1,150 cars conformed to A. A. R. design only in such details as center sills or center-plate height; 504 cars or 1.07 per cent were non-A. A. R. design.

No standard A. A. R. designs of gondola, flat, stock, ballast and special type cars have been developed, and 10,036 cars of these various types were ordered in the period of May 1, 1939 to May 1, 1940. With 1,410 refrigerator cars, this makes a total of 58,382 cars, ordered in the period mentioned, of which 53,384, or 91.44 per cent have standard 25¾-in. center-plate height; 3,229 have 26 ¾-in. center-plate height; 20 have 26 ⅜-in. center-plate height; 1,700 have 26⅛-in. center-plate height; and 49 have 26-in. center-plate height.—Editor]

## Box-Car Floors

The question of damage to box-car floors due to heavy concentrated loads imposed by power trucks when handling steel sheets, ingots, bars and similar lading, was referred to in the report for last year.

It has been decided in view of the information available and experience of certain roads that suitable designs of strengthened floor construction could be developed to cover the situation without conducting special loading tests and general drawings have been prepared to show the strengthened construction.

The construction for general service consists essentially of two 3-in. 6.7-lb. Z-stringers located on each side of the center sill. The diagonal braces have been increased in thickness from ¼ in. to 5/16 in.

Alternate construction where a still stronger floor construction is considered necessary or desirable by individual railroads, consists essentially of two 4-in. 8.2-lb. Z-stringers located on each side of the center sill with diagonal braces increased in thickness from ¼ in. to 5/16 in.

[Two sketches, No. 6 and No. 7, (not included in the present abstract of the sub-committee report) showed this reinforced box car floor construction in detail and included tables of comparative weights and material sizes. It was recommended that these sketches and tables be submitted to letter ballot.—Editor]

## Changes in Standard Steel-Sheathed Box Car

### Corner Construction

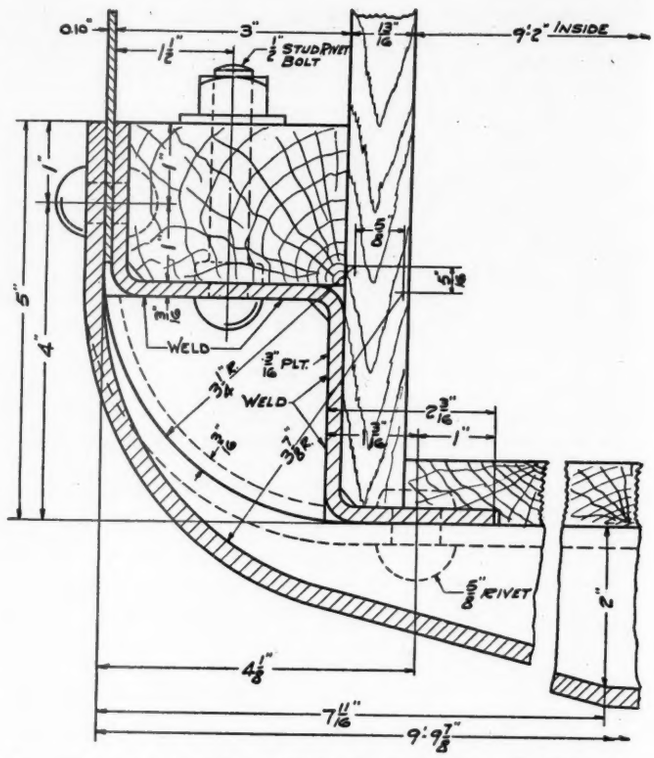
During the past year a study has been made with a view to icreasing the strength of the present square corner and Z-bar corner post construction as shown on Plates 504-B and 1504, Supplement to the Manual for the A. A. R. base designs of steel-sheathed box cars.

To provide added strength against tendency of ends to bend outward with shifting loads, a number of roads already have used a rounded corner construction with a W-section corner post as shown in one of the drawings which accompanies this report. This represents a much more substantial arrangement with only a slight increase in weight as compared with the present square corner and Z-bar corner post.

It is the recommendation of your committee that the arrangement, illustrated, be submitted to letter ballot for adoption and if approved, the drawings in the Supplement to the Manual will be changed accordingly for base cars shown on Plates 500-B and 1500-A respectively.

### Roof Construction

In view of the more general use of an improved solid-steel roof construction, your committee recommends incorporation in the base designs of a solid steel roof intended for future applications in place of the designs now shown on Plates 502-B and 1502.




**Proposed A. A. R. Design of W-Section Corner Post for 40-Ft. 6-in. 50-Ton Steel-Sheathed Box Cars**

The table shows a comparison of the present and proposed base designs. The comparative weight figures shown, apply only to the roof for the 9-ft. 2-in. wide car, as covered by Plate 1502.

Roofs of the proposed design are already in service on thousands of cars and it is believed with the better balanced low cap construction, a design will be provided which permits the entire roof to work as a unit while with the former high cap design there was a tendency for the caps to take the load before the sheet panels came into play.

**Comparison of Present and Proposed Base Roof Designs**

| | Present design plate No. 1502 | Proposed design |
|---|---|---|
| Gage of roof sheets | No. 15 | No. 15 |
| Thickness of seam caps, in. | 5/32 | ⅛ |
| Height of seam caps, in. | 3 3/16 | 2¼ |
| Complete weight per car, lb. | 1,858 | 1,694 |
| Saving in weight per car, lb. | .... | 164 |

Your committee recommends that roof arrangement (shown as Sketch No. 4 in the report) be submitted to letter ballot for adoption. If approved, the drawings in Supplement to the Manual will be changed accordingly for base cars now shown by Plates 500 and 1500.

## End Lining for Box Cars

Present end lining installation as shown on drawings for the standard box cars consists of 13/16-in. tongue and groove vertical lining boards resting directly against the corrugated-steel end and secured by nailing to horizontal wood furring strips located in corrugations and held by stud bolts. The end floor board is rabetted to receive the lower ends of end lining boards and short Z-shaped metal clips are provided for holding the top of lining boards adjacent to the sides of the car.

Exceptions have been taken to this application, particularly by grain and flour shippers who have maintained that lading becomes lodged in corrugations back of end lining boards resulting in shortage, and where not removed affords breeding place for vermin. Further, that to recover lading which may become trapped in this manner usually necessitates the removal and replacement of large sections of the end lining.

Of the various alternate schemes which have been proposed from time to time, the arrangement which has been most frequently suggested by the shippers consists of applying end lining boards horizontally, secured to vertical furring strips attached

to the steel end and having opening with bevel strip at bottom for self-clearing and to permit blowing out when necessary, similar to side lining application. This change in the application of end lining is not considered desirable, mainly because lining boards would be exposed to breakage by being unsupported between furring strips. Furthermore, in order to maintain present inside length of car it would be necessary to increase the overall length an amount equal to thickness of end furring strips and lining boards. To provide strength approaching that of present construction, in which lining boards are supported for the full width of the car, bearing directly against the steel end and with furring strips applied in the corrugations, it would be necessary to closely space the vertical nailing strips and materially increase the thickness of the end lining boards with resultant increase both in weight and cost of construction.

As will be noted by reference to plates 504-B and 1504 of the Supplement to the Manual, wood furring strips extending approximately the full length of the end corrugations are applied in the first three corrugations above the floor line, at center of end and in the top corrugation. If furrings are of sound wood properly attached to the steel end and lining boards are securely nailed thereto, the lining will maintain its position. Examination of a large number of cars has shown that in the majority of cases the end lining follows the steel end when the latter becomes bowed outwardly up to as much as 4 in. at center. If the tongues and grooves of end lining boards are of correct dimensions and provide proper fit, no leakage of grain should occur, therefore, where end lining is properly applied and maintained free from holes or punctures, no difficulty should be experienced because of leakage of lading through the end lining.

Plates 504-B, 1504 show a Z-bar corner post with furring strip between the post and the steel end, this being the furring to which the side lining is nailed. There is, however, approximately 1 in. space between this furring strip and the steel-end extending from floor to roof. The corrugations in the steel end overlap this open vertical channel so that any grain leakage at the corners would be fed to the corrugations and gradually work its way over to the center of the car. Grain leakage at the corner-post opening may be caused by warpage or improper fastening of side lining to furring, short furring strips not fitted tightly against side plate or sill and poor fit between corner end lining boards and side lining. This particular condition may be corrected to a large extent by increasing the size of the corner-post furring strip to completely fill the space between Z-bar corner post and steel end, or by driving a loose wooden strip in between the furring and the steel end, making sure that this opening is blocked solid from side sill to side plate.

However, a new design of corner post construction, covered elsewhere in this report, will, if adopted, materially improve for new cars, the conditions described in the foregoing paragraphs.

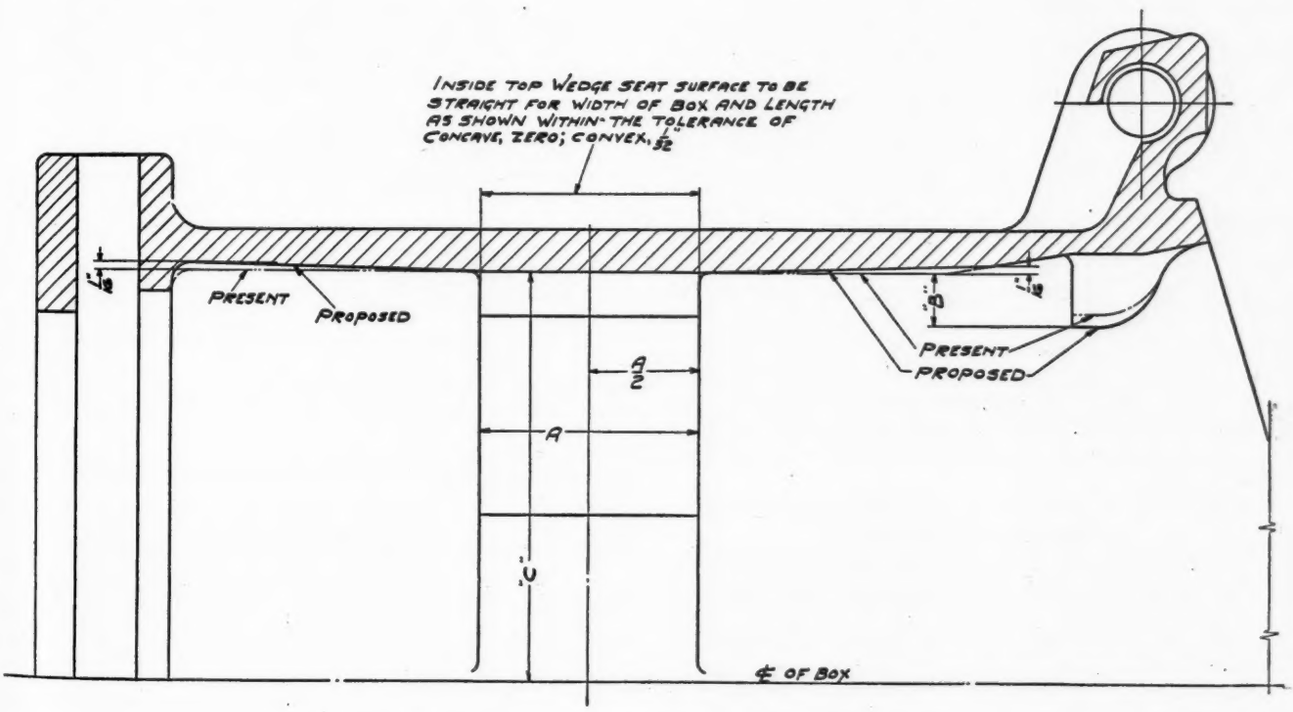
## Side Frames and Bolsters

During the past year, numerous new designs of side frames and bolsters were submitted for approval. Some of these new designs have been approved and in some cases the applications are still pending. Nine new side frame designs were approved, eight for 50-ton trucks and one for 70-ton trucks. Among these are various features of double-truss and spring-plankless designs. They also include Barber stabilized and full-cushion trucks. With the exception of two 50-ton and the 70-ton trucks, these were all of Grade B carbon steel; the exceptions are alloy steel.

The approved bolster designs are 15 in number, of which 8 are in alloy steel, 5 are Grade B carbon steel and 2 pressed and welded-rolled-steel designs. Applications are pending on 12 side frame designs and 7 bolster designs.

## Report of Sub-Committee on Journal Boxes

To provide improved service performance and assist in preventing uneven wear in the roof of the journal box, it is recommended that the inside contour at the top of journal boxes, A, B, C, D, E, and F, be changed as shown in one of the drawings. This drawing also includes recommended increase in the depth of the wedge stop (dimension B) in order to obtain as much


INSIDE TOP WEDGE SEAT SURFACE TO BE STRAIGHT FOR WIDTH OF BOX AND LENGTH AS SHOWN WITHIN THE TOLERANCE OF CONCAVE, ZERO; CONVEX, 1/32
PRESENT
PROPOSED
PRESENT
PROPOSED
A/2
A
℄ OF BOX

| Class of box | Journal size, in. | A, in. | A/2 in. | B, in. | C, in. |
|---|---|---|---|---|---|
| A | 3¾ x 7 | 2⅜ | 1 3/16 | 7/16 | 3⅝ |
| B | 4¼ x 8 | 2⅜ | 1 3/16 | ½ | 4 |
| C | 5 x 9 | 2⅜ | 1 3/16 | ⅝ | 4⅛ |
| D | 5½ x 10 | 2⅜ | 1 5/16 | ⅝ | 4⅞ |
| E | 6 x 11 | 3½ | 1¾ | ⅝ | 5⅜ |
| F | 6½ x 12 | 3½ | 1¾ | ⅝ | 6 |
| Tolerances | + | ... | 1/32 | 0 | 1/16 |
| | − | ... | 1/32 | 1/16 | 1/16 |

**Proposed Changes in the Inside Contour at the Top of Journal Boxes**

contact with the wedge as possible without interfering with removal of same. It will be noted that the B dimension is maximum with tolerance of 1/16 in. less, as shown in the tabulation on this sketch.

The above suggested changes have been approved by the Car Construction Committee and are concurred in by the Committee on Lubrication of Cars and Locomotives and it is recommended that the arrangement illustrated be submitted to letter ballot for adoption and if approved the drawings in the manual on Pages D-14, D-15, D-16, D-17, D-18 and D-19, will be changed accordingly.

## Definitions and Designating Letters

During the past year your committee has passed upon a number of requests from car owners for designating letters for new types of freight and passenger cars. In cases where additions to or changes in the manual are decided upon, the recommendations of other interested divisions of the association were obtained before submitting such changes to the membership by letter ballot.

[The sub-committee here described the letter changes which have already been approved by letter ballot.—Editor.]

Your committee has also passed favorably upon new additional designations as follows: *"CSP"—Combined mail-storage or baggage, dormitory and passenger*—A car having three compartments, separated by bulkheads, one for mail storage or baggage, one fitted with sleeping accommodations for the crew and one fitted with seats for passengers.

*Reason: To provide for a new type of car.*

*"BLF"—Flat car*—A car constructed and equipped for passenger-train service, especially to carry containers for the transportation of liquids or other commodities.

*Reason: To provide for a new type of car.*

## New Designs of Freight Cars

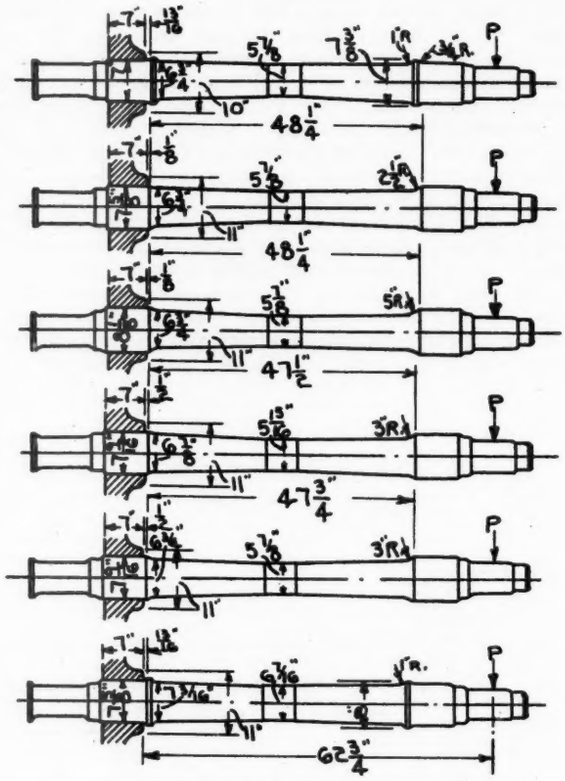
Since the last report, the committee has reviewed the following business in accordance with the revisions of the first paragraph of Interchange Rule 3.

Five designs, submitted by the American Car & Foundry Company, are for reinforced underframes for cars built to transport 15 1-ton chlorine containers, involving a total of 16 cars. One design was submitted by this company for welded and riveted refrigerator car. One design for a tank car, 50 cars; a modified A. A. R. underframe for tank cars, no limit, and a car structure for carrying 15 one-ton chlorine containers, five cars, were submitted by the General American Transportation Company. A new tank car underframe design was submitted by the Fleischmann Transportation Company covering 40 new underframes and 50 rebuilt underframes. A design of freight car with cradles for handling milk tanks, was submitted by Motor Terminals, Inc. A modified A. A. R. 50-ton hopper-car design was submitted by Berwind White Coal Mining Company. A special tank box car for transportation of liquid oxygen, 10 cars, was submitted by Linde Air Products Company. A light-weight box-car design, submitted by Pullman-Standard Car Manufacturing Company, was previously approved for 1,000 cars; the present approval covers the construction of 1,000 additional cars.

## Passenger-Car Axles

In connection with tests of passenger car axles which are being carried on at the Timken plant at Canton, Ohio, the actual tests started on November 20, 1937, and have progressed to the extent that four progress reports have been prepared,* submitted for approval, and then sent out to the member roads. These progress reports show in detail the various designs of axles tested, based on the present A. A. R. 5½-in. by 10-in. journal, having 7-in. wheel seat diameter and black collar. From these tests a new design of axle has been established and is shown on the attached drawing. All of the axles tested were of plain carbon steel, not heat treated after forging, and in accordance with A. A. R. Specification M-101-36, Grade B. The object of these tests was to obtain an axle which would give longer service and life without failure than the present A. A. R. 5½-in. by 10-in. axle. All tests have been confined to improving the axle in the region of the wheel seat inasmuch as most service failures occur inside the wheel fit of the axle a short distance from the inside hub face. To date, these investigations have been limited to those improvements that may be obtained by modifications in design of axles.

The principal modification of design as shown on the attached drawing is increased wheel seat, maintaining the same journal




**Axle Designs Nos. 1, 2, 3, 4, 6 and 5, a Summary of Results of Fatigue Tests on Which Are Shown in the Table**

dimension and approximately the same center and the same body dimensions. To check up on the new design, four axles were purchased to specification M-101-36, Grade B, and four axles to the new design to Specification M-104, normalized and tem-

* A summary of the fourth progress report is appended at the end of this report on Car Construction.

## Summary of Results of Fatigue Tests Made on Six Designs of Full-Size Axles

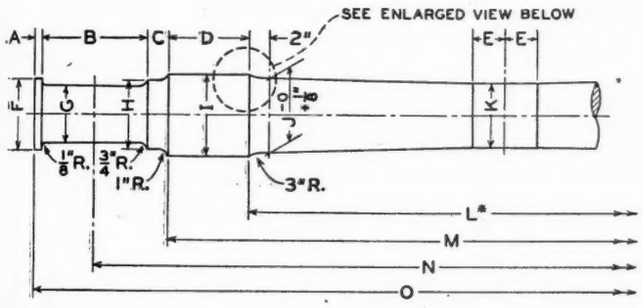
| Axle design no. | Steel spec. | Allowable maximum axle bending stress in wheel seat to prevent: Initiation of fatigue cracks, Lb. per sq. in. | Initiation of fatigue cracks, Per cent | Breaking off of axle, Lb. per sq. in. | Breaking off of axle, Per cent | Increased axle fatigue strength against cracking in wheel seat due to elimination of black collar and use of raised wheel seat, per cent | Fatigue strength of body, Lb. per sq. in. | Fatigue strength of body, Per cent | Comparison of axle capacity: Not to crack in wheel seat | Comparison of axle capacity: Not to break in body |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | M-101 | 9,000 | 100 | 11,000 | 100 | .. | 17,500 | 100 | 1.00 | 1.00 |
| 2 | M-101 | 12,000 | 133 | 14,000 | 127 | 33 | 17,500 | 100 | 1.72 | 1.00 |
| 3 | M-101 | 13,500 | 150 | 16,000 | 145 | 50 | 17,500 | 100 | 2.35 | 1.00 |
| 4, 6 | M-101 | 12,000 | 133 | 14,000 | 127 | 33 | 17,500 | 100 | 1.69 | 1.03 / 1.00 |
| 5 | M-101 | 9,000 | 100 | 11,000 | 100 | .. | 17,500 | 100 | 1.29 | 1.26 |

## New A. A. R. Axle Dimensions

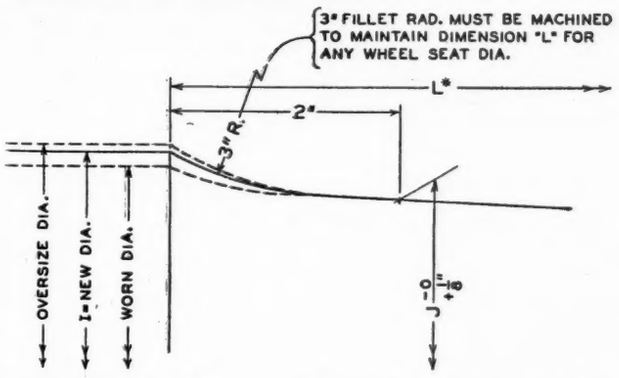
| Classification of axle | Size of journal, inches | Dimensions, Inches A | B | C | D | E | F | G | H | I | J | K | Feet-Inches L | M | N | O |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 3¾ x 7 | 5/8 | 7 | 2½ | 7 5/8 | 1½ | 4¾ | 3¾ | 4¾ | 5½ | 4 7/8 | 4¼ | 3-11¾ | 5-3 | 6-3 | 6-11¼ |
| B | 4¼ x 8 | 5/8 | 8 | 2 | 7 5/8 | 1½ | 5¼ | 4¼ | 5¼ | 6 6/16 | 5 7/16 | 4¾ | 3-11¾ | 5-3 | 6-3 | 7- 0¼ |
| C | 5 x 9 | ¾ | 9 | 2 | 7 5/8 | 1½ | 6⅛ | 5 | 6⅛ | 7 | 6 9/16 | 5⅜ | 3-11¾ | 5-3 | 6-4 | 7- 2½ |
| D | 5½ x 10 | ¾ | 10 | 2 | 7 5/8 | 3 | 6 5/8 | 5½ | 6 5/8 | 7 9/16 | 6¾ | 5⅞ | 3-11¾ | 5-3 | 6-5 | 7- 4½ |
| E | 6 x 11 | ⅞ | 11 | 2¼ | 8⅛ | 3 | 7¼ | 6 | 7¼ | 8 9/16 | 7¼ | 6 7/16 | 3-10¼ | 5-2½ | 6-6 | 7- 6¾ |
| F | 6½ x 12 | ⅞ | 12 | 2¼ | 8⅛ | 3 | 7¾ | 6½ | 7¾ | 8¾ | 7⅞ | 6⅞ | 3-10¼ | 5-2½ | 6-7 | 7- 8¾ |

pered. These axles were tested. Axles to Specification M-104, normalized and tempered, did not show up very well and this raised the question as to the value of such treated material. This matter was discussed with the Committee on Specifications for Materials and later, by a joint committee from the specifications committee, the axle committee, and representatives from the manufacturers.

Inasmuch as the new designs have been approved by the Joint Sub-Committee on Axle Research and as this was the first part of the program, the next step was the testing of axles of the new design with a larger number of axles than the eight axles referred to above. This work is now being progressed, the axles having been ordered. As soon as they have been received they will be put in the test machines. The results of these tests will be in a later report.




*THIS DIMENSION TO BE MAINTAINED ON NEW (INCLUDING OVERSIZE) AXLES AND IN REMACHINING WORN AXLES.




**New A. A. R. Axle Dimensions—Enlarged View Showing Condition at Fillet Joining Body Portion of Axle to Inside Edge of Wheel Seat**

While all of the work, up to this time, has been in re-designing the regular axles, we are now working on the design for drive axles. This work will be progressed as rapidly as possible and if the design for drive axles can be established it should be included in the letter ballot with the non-drive axles. If it is not completed in time for this, it will be recommended that it be covered by a special letter ballot.

In view of the fact that there are a large number of wheels now in service that in time will require new axles, probably of the new design, we are testing out assemblies with one of the existing 5½ by 10-in. journal axles with a wheel that has a three-quarter inch thick hub and have mounted this axle with pressures for cast iron wheels. These tests will be continued and report furnished later.

As in the case of the number of wheels that will be in existence for some time, consideration is also being given to what changes in machining could be done, such as removing the black collar, so that the life of existing A. A. R. 5½ by 10-in. journal axles may be increased. These tests are being conducted with miniature axles as well as with full size axles. This work will also be hurried to a conclusion.

The Joint Sub-Committee on Axle Research recommends that where these axles are used on new cars in passenger service, the load rating of the individual axles should be as follows:

| A. A. R. axle designation | Size of journal, in. | Capacity (lb.) for axles for speeds of approximately 100 m.p.h. | Where speeds do not exceed 85 m.p.h., following capacity (lb.) may be used |
|---|---|---|---|
| A | 3¾ by 7 | 12,000 | 12,500 |
| B | 4¼ by 8 | 19,000 | 20,500 |
| C | 5 by 9 | 25,500 | 27,000 |
| D | 5½ by 10 | 32,000 | 34,000 |
| E | 6 by 11 | 40,000 | 42,500 |
| F | 6½ by 12 | 48,000 | 51,000 |

The Joint Sub-Committee recommends that the new design of axle for 3¾ by 7-in. journals up to and including 6½ by 12-in. be submitted to letter ballot and that the letter ballot also include the ratings established for these axles when used in new passenger car equipment.

This part of the report was signed by W. I. CANTLEY, *Chairman*, Joint Sub-Committee on Axle Research.

## Standard Contour for New Passenger Cars

With the advent of streamlined passenger trains, the desirability for uniform exterior appearance of passenger cars has been recognized, and this sub-committee was appointed to make a study with a view to developing a standard contour for new passenger cars, that could be followed by railroads and car builders in the interest of improving appearance of passenger trains when cars of various railroads and Pullman equipment are intermingled.

Fig. 1 shows proposed "Standard Contour for New Passenger Cars" which has been developed, keeping in mind certain fundamentals such as cross-section of car, over-all height from rail, height of lower glass line from rail, height of foot plate from rail and width over side posts. Fig. 2 (not included in this abstract of the committee report) indicates the basis on which the proposed contour was arrived at.

It is recommended that contour shown in Fig. 1 be submitted to letter ballot. If approved, drawing will be prepared for inclusion in the Manual.

## Lettering and Marking for Automobile Device Cars

To handle satisfactorily some of the newer model automobiles in which the width of bodies has been increased, also some of the models with considerably increased overhang from the center of the rear wheel to the rear end of the body, certain changes are contemplated or are being made in the loaders.

To take care of the wider bodies, 7 in. additional width is being provided between the front arms of the present type D loader, which results in a minimum clear width between the front arms of 82⅝ in. at a point 10 in. above the top of the wheel pan.

To take care of the automobiles with the increased overhang, the width of the rear cross frame on the Type D loader is being decreased from 16 in. to 8 in. It is the recommendation of this sub-committee that, where changes are made in the Type D loader, as referred to above, marking be used as follows:

*D Plus*—Latest rack having arched 26 in. wide front cross frame, 16 in. wide rear cross frame, 9 point adjustable rear hubs,

telescopic front and rear legs and with front arms spread to provide at least 82⅝ in. width in the clear at a point 10 in. above top of wheel pan.

*E*—Latest rack having arched 26 in. wide front cross frame, rear cross frame reduced from 16 to 8 in. wide, 9 point adjustable rear hubs, telescopic front and rear legs and with front arms spread to provide at least 82⅝ in. width in the clear at a point 10 in. above the wheel pan.

The report was signed by P. W. Kiefer (chairman), chief engineer motive power and rolling stock, N. Y. C.; T. P. Irving (vice-chairman), engineer car construction, C. & O.; W. A. Newman, chief mechanical engineer, Can. Pac.; J. McMullen, superintendent car department, Erie; F. A. Isaacson, engineer car construction, A. T. & S. F.; G. S. Goodwin, mechanical engineer, C. R. I. & P.; H. L. Holland, assistant engineer, B. & O.; E. B. Daily, engineer car construction, Sou. Pac.; J. T. Soderberg, general foreman, Penna.; T. M. Cannon, engineer car construction, C. M. St. P. & P.; and F. J. Jumper, general mechanical engineer, Union Pacific.

## Summary of Fourth Progress Report Passenger-Car Axle Tests

[The Summary of the Fourth Progress Report of Passenger-Car Axle Tests, issued on April 1, 1940, is appended here, as it forms the basis for the recommendations of the Sub-committee on Passenger-Car Axles in the report above.—Editor]

In this fourth progress report the investigation of the influence of the design of the axle on its fatigue strength is practically completed except for generator-drive pulley carrying axles. Three progress reports have been issued since the initiation of the program on the fatigue testing of full size 5½-in. by 10-in. passenger-car axles. This report practically completes the testing program on six different designs of full size axles.

In all six axle designs the allowable design fatigue strength was investigated for both (a) the wheel seat with mounted rolled-steel wheel, and (b) the body portion of the axle included between the wheel seat without the presence of clamped pulleys. No investigation was made of the journal and dust-guard portions of the axle.

### Effect of Axle Shape

Summary results of all fatigue tests of full size axles for six different designs are shown in comparison with the existing axle designs in the table.

Axle Design 6 is considered as the design for the proposed new axle. It meets the practical requirements for (a) wheel-mounting tolerance conditions, (b) minimizes the scrapping of existing wheels due to having too thin a hub section, and, (c) gives an allowable design fatigue strength in the wheel seat 60 per cent to 80 per cent greater than the present design of axle (Design No. 1).

The increase in the 7-in. wheel-seat diameter of the present axle (Design 1) to 7 9/16 in. in the proposed new axle (Design 6) is accountable for 25 per cent increased strength. The remainder of the increased fatigue strength obtained is due to a change in the shape of the axle wheel seat, whereby the black collar is eliminated and a raised wheel seat is formed on the axle.

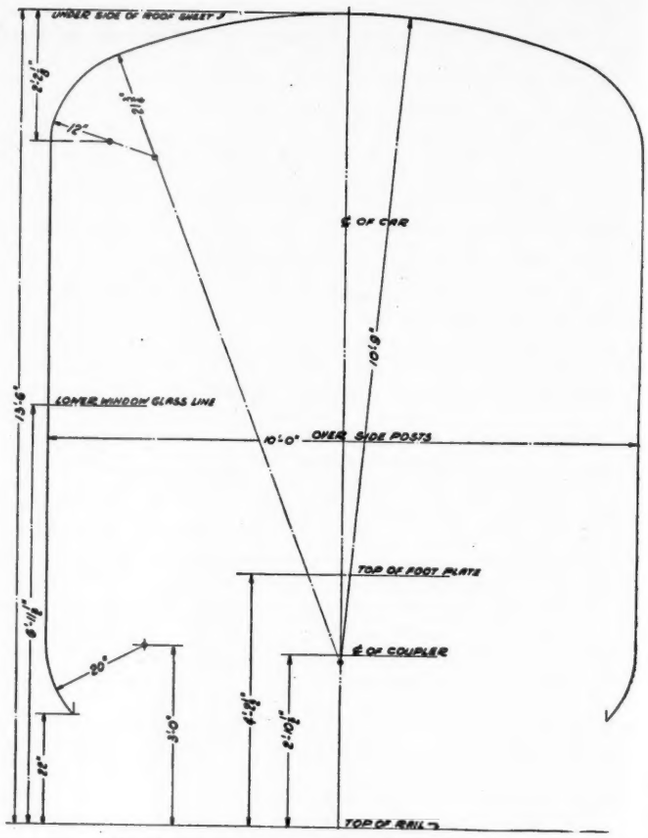
All these tests on axle shape were made on steel to A. A. R. Specification M-101.

### Effect of Axle Material

A total of 87 full-size axles have been tested from as-forged material to A. A. R. Specification M-101. Only a total of eight axles have been tested from normalized and tempered material to both A. A. R. Specifications M-104, Class A and M-101. The limited number of tests made on normalized and tempered axles does not justify definite conclusions at this time and additional axle tests will be made.

### Machining Smaller Axles from Larger Axles

A number of machined axle forgings from M-101 material were originally supplied at the beginning of the axle test program for use with 8⅛-in. diameter wheel seats (Design 3). It was not found necessary to use all these axles for the original purpose for which they were intended and it was decided to test these remaining axles after turning the wheel seat for the next smaller wheel seat diameter of about 7⅝-in. (Design 2, 4 and 6).




**Standard Contour for New Passenger Cars**

Tests of these axles showed that the fatigue strength varied from zero to 10 per cent less than for similar axles machined from the proper forging size. Axle life is also less. It is apparent that the practice of machining smaller axles from larger axles may lead to a loss in axle fatigue strength as determined from the use of M-101 steel used in these tests.

### Re-design of Axles in A. A. R. Classifications

Recommendations are contained in this report for the dimensions of the re-designed axles in classifications A through F and recommended designs of two additional axle sizes, 7 in. by 13 in., and 7½ in. by 14 in. Such re-design was based on the test results of the proposed new 5½-in. by 10-in. axle known as Design No. 6.*

These proposed new axle dimensions give an increase of about 60 to 80 per cent in the allowable design fatigue strength of the wheel seat over that of the existing axle designs. The diameter of the body portion of these re-designed axles at the center is the same and the body taper is practically the same as on existing axles. It is the intention later to provide a separate design of axle in the center portion to improve the fatigue strength of the existing axle due to detrimental clamping effect of the drive pulley.

### Effect of Clamping Generator Pulleys on Axles

Investigation is underway on ¼ scale size axle tests of M-101 material to determine the detrimental effect on the fatigue strength of the body of the axle due to clamping of a generator drive pulley. Means of improving this axle fatigue strength are also being tested. None of these tests have progressed far enough to arrive at even tentative conclusions.

* The dimensions of re-designed axles classifications A through F are set forth in the section on Passenger-Car Axles in the above report.

### Effect of Reducing Wheel-Hub Thickness

Increasing the wheel-seat diameter on the proposed new axle designs will, in accordance with existing rules, scrap a number of wheels due to haing too thin a hub section. Test of a full-size axle (Design 1) was therefore just initiated where the rolled-steel wheel-hub section was made ¾ in. thick at both hub faces. The press fit of the wheel on this axle was .0047 in., giving a mounting tonnage of 45 tons. If the test of this one wheel and axle assembly is satisfactory additional tests will be necessary further to determine if it is practical to use ¾-in. hub thickness in service in order to avoid scrapping wheels.

The object of this test is:

(1) To determine if the hub of the wheel will fail with the minimum ¾-in. hub thickness shown. The reason for desiring to have this information is that the proposed new design of axle will scrap a number of wheels because of the present rules as to minimum wheel-hub section thickness.

(2) The thinner hub section may increase the fatigue strength of the axle in the wheel seat portions.

(3) The reason for machining out the wheel disc on the journal side of the axle is to determine from these tests if the light wheel-hub section will have sufficient holding power on the axle to prevent the axle pulling out of the wheel during the test.

(4) It is also desired to mount this wheel on the axle within the tonnage limits now specified for cast-iron wheels on axles instead of using the tonnage limitation provided for steel wheels.

In discussing this report, A. J. Krueger, superintendent car department, Nickel Plate, said that in his opinion the so-called modern lightweight steel freight car has not been in service long enough to permit evaluating all of the economic factors and mechanical details, such as initial cost, maintenance, weight saving, sizes of material, spring suspension, side bearings, brakes, draft gears, trucks, etc. Mr. Krueger said that the future design of such cars will depend upon service results with respect to full protection against corrosion at all metal joints; resistance of the material itself to distortion and rupture on account of increased flexure; degree of acceleration of such distortion or rupture resistance of the parent metal to oxidation; affinity between the parent metal and paint materials; service life as affected by the degree of welded or riveted construction employed; practicability of maintaining cars with present repair track facilities; and the resistance of the new steels to impact loading or stress at low temperatures.

Mr. Krueger congratulated the committee on its constructive report and urged further cooperation of all railroads in furnishing information regarding service performance so that the joint efforts of car builders, railroads and car operators may result in establishing the characteristics of the most economical car unit. Regarding the question of how much rigidity of flexibility should be built into a car design, Mr. Krueger said there is some question and mentioned the experience of welding pipes to cross members, bolsters, etc., in cars with results which, in his judgment, have proven to be undesirabe.

K. F. Nystrom, mechanical assistant to chief operating officer, C. M. St. P. & P., offered a resolution that the committee be asked to specify the point at which the side sheet should end and the skirting begin on the passenger-car cross-section contour proposed by the committee. Mr. Nystrom offered no objection to the contour itself, but in view of the fact that some roads are not favorably inclined to the use of the skirting, felt that the location on the drawing of the point referred to would tend toward uniformity of treatment in such cases. The resolution was adopted and Mr. Kiefer said that the committee would be glad to consider the location of the point in question.

In closing this report, Chairman Kiefer said that the original standard box car of 1932 demonstrated about 20 per cent greater strength than the conventional cars with which it was checked in comparative tests and this car is generally accepted as the yardstick for durability of freight equipment. He said that car life is an important factor which must not be sacrificed for the sake of light weight and the effort has been to produce a car in which weight is saved without reducing the prospective car life.

D. S. Ellis, chief mechanical officer, C. & O., complimented the committee on producing a constructive report which obviously represented the expenditure of a great amount of time and effort. He moved that the committee be extended a vote of thanks and the report be accepted with recommendations submitted to letter ballot. *This motion was carried.*

# Intercrystalline Cracks in Locomotive Boilers[1]

By W. C. Schroeder[2], A. A. Berk[3] and R. A. O'Brien[4]

The use of welded drums in stationary practice probably presages steady diminution of intercrystalline cracking in this field, for such construction eliminates the riveted areas which experience has shown to be most prone to this type of failure. In locomotive boilers no general tendency toward the use of welded drums is yet in evidence, consequently alleviating the trouble depends on proper attention to (1) the construction of the boiler, (2) the treatment of the feedwater, or (3) combination of the best construction with adequate feedwater treatment.

The Association of American Railroads, recognizing this situation, has contributed generously to an extensive investigation of this problem. From the standpoint of protecting riveted stationary boilers already in service, the work has also been sponsored since its inception by the American Boiler Manufacturers Association, American Society of Mechanical Engineers, American Society for Testing Materials, American Water Works Association, Edison Electric Institute, and other interested groups.

This investigation has been carried out in cooperation with the Bureau of Mines, which has furnished not only excellent facilities but also the services of experimental investigators.

Considerable attention has been devoted to understanding how the cracks occur as a guide toward finding and evaluating methods of feedwater treatment that may be used to prevent them.

Three factors combine to produce intercrystalline cracks in a boiler: (1) leakage that allows concentration of the boiler water, (2) high stress in the boiler metal, arising either from cold work or applied stress, and (3) chemical action of the concentrated boiler water on the stressed steel.

## Concentration of the Boiler Water

It has never been possible to show that a dilute alkaline solution, such as ordinarily present in a locomotive, will produce intercrystalline cracks when in direct contact with stressed specimens of normal low carbon steel at any temperature used in boiler operation. It is not necessary to show this, however, to account for the appearance of intercrystalline cracks in a riveted boiler seam. Instead of the dilute water acting on the steel, a *concentrated* solution produced in the seam is the attacking agent.

Several mechanisms have been advanced to explain this concentration process. That most easily demonstrated depends on the extremely slow diffusion of water vapor out of the seam to leave therein a deposit of concentrated solution and solid. The most dangerous type of leakage is that which allows an almost imperceptible loss of water vapor to the atmosphere.

Leakage from an opening so small that the boiler water can diffuse through it only very slowly probably would never be directly visible on an engine and certainly never enough to cause removal from service. It could be discovered in a cold test only with most careful inspection. When the boiler is under full steam pressure, however, such leakage might be found with a cold glass or mirror on which steam escaping from a riveted seam will form a faint haze of condensate. Over long periods of time rates of leakage undetectable even by this rather sensitive means can create concentrated solutions.

## High Stress in the Boiler Metal

It has been known for a long time that intercrystalline cracks occur most readily when the metal is under a high tensile stress. In fact no definite evidence has been advanced to show that they can be produced in unstressed steel or in steel subjected to compression.

This usually has been interpreted to mean applied stress;

[1] Published by permission of the Director of the Bureau of Mines—U. S. Department of the Interior.

[2] Senior chemical engineer, Eastern Experiment Station, Bureau of Mines, College Park, Md.

[3] Assistant chemist, Eastern Experiment Station, Bureau of Mines, College Park, Md.

[4] Assistant metallurgist Joint Research Committee on Boiler Feedwater Studies, attached to the Eastern Experiment Station, Bureau of Mines, College Park, Md.

therefore in laboratory work to produce intercrystalline cracks the specimens were put under tensile load by dead weight, springs, lever or hydraulic systems. It can be shown that an applied tensile force is not always necessary to produce cracks. If the inner surface of a rivet hole has been cold-worked through punching, drilling, drifting, or other mechanical operation the necessary internal stress may exist to cause cracking in the absence of any further applied load.

The desirability of preventing extensive cold distortion of the metal during fabrication of the boiler is apparent from this work. Excessive distortion of the metal would create all the stress necessary to cause embrittlement, and at the same time would make it almost impossible to keep the boiler free from leaks that would allow the formation of concentrated solution in the riveted seam.

For a number of years manufacturers have recognized the necessity for eliminating this type of construction. Plates are carefully fitted together, all burrs and chips are removed from between them, all rivet holes are drilled rather than punched, and the holes are reamed in place to secure proper alignment. Rivets are driven by machine so that the heads are well centered over the shanks.

Internal calking has been used quite generally in recent years, in locomotive construction. Operating experience has not as yet clearly demonstrated the superiority of internal-external calking over external calking alone.

To secure a tight fit between locomotive shell courses they are sometimes shrunk together. The advisability of this procedure is debatable. The shrinking probably secures a better fit between the shell courses, which will greatly aid in preventing leakage, but it may set up extremely high tensile stresses that will promote rapid cracking in case any concentrated solution does form. According to the writers' information one of the railroads which has had considerable difficulty with circumferential seam cracking did not follow the practice of shrinking courses together and it may be concluded that elimination of the stresses from this source is not a sure way to prevent embrittlement.

## Action of Concentrated Solutions on Stressed Steel

In the riveted seam of a locomotive boiler we have seen that two of the conditions can exist which are necessary to cause intercrystalline cracking; namely, leakage that will allow the formation of a concentrated solution, and high stress in the metal. To actually crack the steel still another factor must be acting; a boiler water which on concentrating will have the correct chemical characteristics to attack the grain boundaries of the metal.

This chemical problem is extremely complex, and as it has been treated in some detail in previous publications only the most practical aspects concerning caustic solutions need be repeated here.

A stressed steel specimen placed in direct contact with a very concentrated sodium hydroxide solution, boiling under atmospheric pressure, will suffer intercrystalline cracking. This attack can be hastened greatly by adding very small amounts of certain chemicals, generally classified as oxidizing agents, to the solution. When the solution is raised from the atmospheric boiling point to temperatures used in locomotive operation, the oxidizing agents lose their effectiveness in accelerating the cracking. A trace of certain types of silica sometimes will promote attack and the influence of this compound becomes even more important at still higher temperatures (corresponding to 500 pounds pressure and above). The action of the silica is complex and its influence will be treated in further detail later in this paper.

Several theories have been advanced to explain intercrystalline cracking in boiler steel. The one that best correlates available information is based upon a process of selective corrosion.

## The Embrittlement Detector

A set of conditions that produce intercrystalline cracking in locomotive boilers has been outlined. If these ideas are correct, a testing device can be used to show whether or not a locomotive boiler water can cause this type of failure. Furthermore, the equipment can be attached directly to the boiler so that a portion of the water continuously pours into or through it, avoiding sampling with its attendant difficulties and errors. The "embrittlement detector", has been successfully developed for this purpose.

## Prevention of Intercrystalline Cracks

From the three factors known to be involved in the production of intercrystalline cracks it is evident that for new locomotive boilers two entirely different approaches might be employed for their elimination; i.e., to build the boilers in such a manner that they are not susceptible to cracking or to treat the water so that it will not cause cracking in any boiler.

In many ways the former of these has all the advantage, for the operator could then forget about embrittlement through the life of the locomotive. On the other hand, if he relies on feedwater treatment, he must constantly and continuously have reports on chemical conditions. This is difficult for a railroad with hundreds of engines in service over a wide geographical area and raw water conditions subject to the vagaries of season and weather.

However, there are thousands of old locomotives in service and it is not yet certain that new boilers, because of construction limitations, are immune. Therefore, in spite of the difficulties, feedwater treatment frequently must be relied upon to prevent embrittlement. Sodium sulfate has sometimes been recommended for this purpose but it will be shown that its influence on locomotive boiler cracking is extremely doubtful. In many instances the data indicate that organic materials will give better results

## Construction of Boilers Resistant to Embrittlement

Embrittlement, in the very great majority of cases, has been found in the riveted seams of boilers. A direct remedy for the trouble would be to eliminate such seams, a practice now commonly followed in stationary boilers through the use of welded or forged drums. While welding has not yet been generally allowed for locomotive boilers, one test engine so constructed is reported to have operated successfully several years and may foretell very definite advances in this direction. Permitted use and adoption of welded seam construction is a direct and, judging from stationary experience, foolproof method that prevents this type of cracking.

A steel resistant to embrittlement would offer another solution. A number of years ago, Fry* reported that Izett steel had qualities superior in this respect to ordinary boiler flange steel. During the spring of 1939 the authors discussed this material with two engineers from the Fried. Krupp Company. It was their belief that in recent years it had been improved and now had greater resistance to embrittlement cracking. These engineers forwarded a small sample, designated as Izett II, for testing.

In three of four tests made of this steel in the embrittlement detector, no cracking was found. The other test showed some surface checking and three or four fine, extremely short cracks which, even after severe bending of the specimen at the end of the test, were only a few thousandths of an inch deep. Investigation for longer periods which is now being conducted, may crack this steel but it appears definitely superior to any American boiler plate that has been tested in the embrittlement detector. The results would indicate that study to develop for use in locomotives a steel that is resistant to embrittlement is not without promise.

A series of tests, comparable with those on the Izett steel, is now being conducted on a steel of American manufacture which was treated with aluminum and may be thoroughly deoxidized.

In locomotive construction low-alloy steels have been in common use in the past few years, generally with the express purpose of saving weight in order that the safe load on tracks and bridges may not be exceeded. These steels may have different characteristics in embrittlement tests from low-carbon boiler flange steel. The locomotive manufacturers, aware of this fact, have started cooperative work that may help to guide them in the selection of steel for new boilers.

Regardless of the steel used for construction, too much stress cannot be placed on careful design and shop practices. The ex-

* The Behavior of Materials Used in Boiler Construction When Subjected to Service Conditions. Ing. Fry. Kruppsche Monatshifte, V. 7, pp. 185-196 (November, 1926).

perience of German engineers with stationary boilers aptly illustrates what may be accomplished by careful construction*. From the time of the war until 1925 or 1926, embrittlement was as prevalent and annoying in Germany as it was in this country. The German engineers, in contrast to those in the United States, did not believe that water conditions were the only important factor, but instead that cracking was caused by poor boiler construction resulting from the haste and pressure of war conditions. With this idea in mind they improved their shop technique as much as possible and reported results indicate that this approach has been successful, greatly reducing and almost eliminating cracking in stationary boilers.

Some very interesting data have been accumulated from one railroad in the United States illustrating the unexpected manner in which serious embrittlement trouble may arise, and the difficulty of isolating the cause from the complex factors of design, workmanship, and chemical condition of the water that are known to be involved. A comparison of the number of engines in a given class that were embrittled, with the year in which they were built including only classes with 10 or more engines shows that of 602 engines built between 1902 and 1921 only 6, or one per cent, were cracked at the end of 1937. Individual classes are also interesting. For example class 1 with 211 engines suffered embrittlement in one, and class 5 with 150 engines did not have any cracked. The maximum percentage cracking is 20 for class 7.

Of 335 engines built between 1924 and 1930, not one per cent, but 120 engines or 36 per cent were cracked by 1937. In class 13, 34 boilers from a total of 45, or 76 per cent, were embrittled. Fifty-four per cent of the boilers in class 11 were cracked.

It seems reasonable to believe that there was some definite change, probably in engine construction or feedwater treatment, that caused the marked increase in cracking after 1921. The design and construction have been examined as closely as possible to determine what this might be. Changes were made from triple to double riveted circumferential seams and the efficiency of the longitudinal seams was also increased from 80 per cent to approximately 90 per cent, which resulted in the thickness of the boiler sheets being decreased. Riveting methods and pressures probably have gone through several changes over this long period; from hand to high pressure machine riveting and then back again to machine with care exercised to prevent excessive distortion of the plate. This may be a significant factor although this road has not yet discovered a riveting pressure that will prevent embrittlement. The steel used for the shell courses might also have altered over a period of years to be more susceptible to cracking. This argument is not too strong, however, for another railroad experienced its greatest difficulty between 1912 and 1926, indicating that some of the steel plate during this period was susceptible to cracking.

Up to 1926 only a small portion of the feedwater was treated to prevent scale and corrosion. At that time general conditioning was started on the road, using external treatment on some supplies and internal on others. This essentially eliminated scale formation as well as pitting and corrosion and also probably caused an increase in sodium hydroxide concentration in most of the boilers. It might be concluded that this was the important factor in causing embrittlement but *careful note should be taken of the fact that 335 locomotives, built prior to 1921, were still in operation in 1937 using the same water supply as the new locomotives and these do not have appreciable cracking difficulties.*

This clearly focuses the question as to why these older boilers can use an embrittling water without much difficulty. So far, as noted, differentiation between new and old boilers on the basis of construction factors alone has not been possible. Perhaps the use of the older engines, while the water formed scale, and was corrosive, created conditions in the seams that were unfavorable to embrittlement. Specifically, these might consist of deposits of calcium silicate or sulphate that prevented leakage. It is, however, difficult for the writers to believe that protection based on mechanical plugging to prevent leakage could exist over a period of years in a locomotive boiler.

While mechanical plugging of the seam is of doubtful significance, a thin film, chemically bonded to the steel surface, may have greater protective value. Detector specimens exposed to certain types of boiler water have been found covered with very thin and extremely adherent calcium or iron silicates. Even if leakage did occur such a film could separate the concentrated solution from the metal surface to prevent cracking. If this explanation is correct experimental demonstration may be possible.

Before treatment was in general use on this road, the locomotive boiler waters were quite corrosive, and caused a great deal of pitting and rusting. In the seams this may have formed an oxide coating through which it would be difficult to start cracking even in contact with the concentrated alkaline solution. Experimental testing of this possibility has been begun.

Clear cognizance should be accorded the fact that not all the engines manufactured since 1924 have cracked, in spite of the fact that they normally seem to operate with highly embrittling waters. In other words, the engines built prior to 1921 may be protected by scale or corrosion, but some engines built after 1924 also can use embrittling waters without cracking. This may indicate differences of construction with important bearing on embrittlement, hidden even in engines of identical design. Not understanding these differences it remains for the locomotive boiler manufacturer to keep cold work stress at a minimum and yet to keep the boiler as free from leaks as possible.

## Conclusions

Two of the three factors are independent of water conditions. Therefore, if sodium sulfate or any other compound is maintained in a boiler water and cracking does not occur it cannot be concluded that the water contained a protective agent. The boiler may have been so constructed that it would not have cracked in the absence of such treatment. This complex situation makes difficult the interpretation of statistical results and probably explains the widely different opinions regarding the action of sodium sulfate held by some engineers responsible for stationary boilers as compared to the opinions held in railroad practice.

Results from three different types of laboratory testing equipment have not shown that sodium sulfate will stop cracking of the specimens. This is true even under conditions that appear to represent closely those existing in a riveted seam. Data reported by the railroads would tend to support these results.

Waste sulfite liquor has been found to stop cracking of hot-rolled boiler-flange steel specimens in the detector tests. Sodium sulfate and sodium chloride were found to interfere with the protection shown by waste sulfite liquor. In spite of this limitation it may have played an important part in stopping one very prolonged case of embrittlement on one railroad. A second road, that has used this material for about two years, reports a sharp decrease in engines found leaking from cracks in road service. The use of waste sulfite liquor is not recommended without chemical control of the concentration in the boiler water or without use of the embrittlement detector to insure adequate treatment.

Any feedwater treatment used to prevent embrittlement cracking must be under continuous control. On the other hand, if a boiler is constructed which is resistant to embrittlement the danger is removed throughout its life. Welding the seams would be one means of accomplishing this purpose but at the present time such construction is not generally permitted in locomotive boilers. Another possibility would be the use of a steel resistant to intercrystalline cracks. Tests in the embrittlement detector show that Izett steel may be better in this respect than ordinary boiler flange steel.

Even with present methods a great deal can be done to prevent trouble when the locomotive boiler is being built. The importance of careful design, construction and shop practice cannot be overemphasized. Every care should be exercised to make the seam tight and to prevent excessive cold distortion of the metal.

Even though water treating methods to prevent embrittlement are complex and suffer definite limitations, the evidence from railroad operation indicates that their combination with good construction can reduce costly and dangerous embrittlement cracking.

[This report was presented by D. W. C. Schroeder.]

F. E. Russell, mechanical engineer, Southern Pacific, expressed his interest in the hypothesis set forth by the author to account for the intercrystalline weakening of a boiler material under conditions of high caustic concentration and stress. He considered the embrittlement detector developed in the investigation conducted under the joint support of the A. A. R. and other organizations for the solution of the embrittlement problem a

* As described by a member of the Vereinigung der Grosskesselbesitzer in 1936.

valuable contribution. The hypothesis which requires a combination of slow leakage and stressed metal as well as caustic concentration is fortunate since it would be very expensive to eliminate the chemical factor alone. With the character of shop practice shown in some of the slides by the author, he said, it would not be surprising to have trouble of the kind indicated. Boiler sheets, he said, should be handled with care to protect the surface. This will go a long way to prevent all kinds of chemical attacks.

In fabrication there should be no drifting of rivet holes, reaming alone being employed. All lubricants and cuttings should be removed before riveting. No sharp-edged calking tools should be employed and inside calking should be light because the rivets are usually too far apart to support heavy calking. Riveting, he said, should preferably be hydraulic. With proper shop practice he expressed the opinion that the riveted locomotive boiler would approach the welded stationary boiler in freedom from chemical attack. On the Southern Pacific, he said, there have been no cases of embrittlement. This road uses the Zeolite water treatment.

H. G. Miller, engineer tests, C. M. St. P. & P., was inclined to disagree with Mr. Russell that riveted construction can approach welded construction in freedom from the embrittlement difficulty. As long as joints are riveted the metal will be locally and unsymmetrically stressed.

*The report was accepted with a rising vote of thanks.*

# Report of Arbitration Committee

During the year Cases 1772 to 1778, inclusive, have been decided and copies forwarded to the members. A copy of these decisions is made part of this report. A vote of concurrence in the decisions is respectfully requested by the committee.

It is the intent that repairs to foreign cars should be confined to the minimum, in order that car owner may have opportunity to perform as much of the maintenance work on his own equipment as possible. Revisions of Rules 1 and 16 are recommended which should clarify this feature.

The requirement in Paragraph (b-10) of Rule 3 which provides that brake shoes meeting requirements of A. A. R. Specification adopted in 1935 are required on all cars when received from owners, has been in the rules since January 1, 1936. No requests for extension of effective date beyond January 1, 1941, have been received. The committee feels sufficient time has elapsed to permit compliance and that no further extension of effective date is justified.

Attention is directed to modification of Paragraph (4) of Section (t) of Rule 3 issued in Supplement No. 1 in March, 1940, as result of letter ballot action, making the prohibition against acceptance of cars having arch bar trucks a general interchange requirement effective July 1, 1940.

A new paragraph is recommended under Rule 17 to provide a tolerance in width for application of running boards, which it is felt should be permitted due to variations in commercial widths as purchased from the manufacturer and shrinkage while in stock.

With the concurrence of the Committee on Couplers and Draft Gears, an addition to Rule 20 is recommended to provide for alignment of drooping couplers by the application of coupler shims in cases where coupler is not below prescribed minimum height from top of rail.

A revision of Rule 44 is recommended which provides a more explicit definition of the defects enumerated under this rule and which it is felt will facilitate inspection of cars in interchange.

Recommendation was submitted in the 1939 report and approved, to provide separate depreciation for tanks renewed on existing underframes and trucks for use in settlement for destroyed tank cars. Investigation discloses a number of existing tanks have been mounted on new underframes and new trucks. Therefore, a further modification of the rule is recommended to extend the same principle to this reverse operation.

Studies are being conducted on a number of representative railroads of the overhead allowances now used in formulating the A. A. R. labor rate. If it develops modification is necessary as result of this study, with the approval of the General Committee the revision will be included in the 1941 Code.

The committee does not feel that any of the modifications included in its report necessitate submission to letter ballot.

All recommendations for changes in the Rules of Interchange submitted by members, railroad clubs, private car owners, etc., have been carefully considered by the committee and, where approved, changes have been recommended.

Attention is again directed to the fact that the Arbitration Committee will not consider questions under the Rules of Interchange unless submitted in the form of Arbitration Cases as per Rule 123.

## Freight Car Rules

### Rule 1

The committee recommends that this rule be modified, effective August 1, 1940, as follows:

*Proposed Form:* Rule 1. (a) Each railroad is responsible for the condition of all cars on its line, and must give to all equal care as to inspection *and lubrication.*

(b) Repairs should be made by car owner insofar as may be practicable. In the event a foreign car requires repairs account of owner's defects, *such repairs may be made subject to the following conditions:*

*1. Repairs to loaded cars must be confined to the minimum necessary for the safety of cars, lading and trainmen.*

*2. Repairs to empty cars located at points where there is a direct connection with car owner, or where there is an intermediate switching line to car owner and cars are acceptable to such switching line for movement to car owner, must be confined to the minimum necessary for safety of trainmen and safe movement of car to home line.*

*3. Repairs to empty cars at other points must be confined to the minimum necessary for safety of car and trainmen, except where car is to be loaded on repairing line, in which event paragraph (b-1) applies.*

*4. Empty cars of lower loading classification may not be repaired for Class A loading without car owner's consent.*

5. Cars requiring repairs so extensive as to be reportable under Rule 120, *shall* be handled in accordance with that rule.

*Reason:* To clarify the intent that repairs to foreign cars should be confined to the minimum and to give car owner an opportunity to maintain his own equipment.

### Rule 2

The committee recommends that first paragraph of Section (b) of this rule be modified as follows:

*Proposed Form:* (b) Cars loaded with explosives *and other dangerous articles* must be handled in accordance with the *I. C. C.* Regulations.

*Reason:* The same penalties are provided for violation of these Regulations with respect to "other dangerous articles" enumerated therein, as for violations involving explosives.

The committee recommends that Paragraph 2 of Section (f) of this rule be modified, effective August 1, 1940, as follows:

*Proposed Form:* 2. All truck defects on foreign cars; except defective metal bolsters or center plates cast integral therewith, defective truck sides and metal transoms, defective non-A. A. R. standard journal boxs where the A. A. R. standard is not a proper substitute. *However, where a loaded car is equipped with type of trucks prohibited under Rule 3, transfer authority is proper.*

*Reason:* To relieve receiving line from expense of transfer on cars which are prohibited in interchange under Rule 3.

### Rule 3

The committee recommends that effective dates for various requirements in the present rule, as listed below, now set at January 1, 1941, be extended to January 1, 1942:

Section (b), Paragraph (8)—Bottom rod and brake beam safety supports.

Section (b), Paragraph (9)—Braking power.

Section (c), Paragraph (11)—Couplers having 5 by 5 inch shanks.

Section (j), Paragraph (2)—Journal boxes, repacking of.

Section (t), Paragraph (3)—Application of welded side frames having "T" or "L" section compression or tension members.

Section (u), Paragraph (4)—Class E-3 cars not to be accepted from owner.

*Reason:* The present situation justifies these extensions.

The committee recommends that no further extension beyond January 1, 1941, be granted for effective date of requirement contained in Paragraph (10) of Section (b) of this rule, specifying that cars must be equipped with A. A. R. 1935 Specification brake shoes to be acceptable from owner.

*Reason:* This requirement has been in the rules for several years and it is felt sufficient time has elapsed to permit compliance therewith.

The committee recommends that Paragraph (3) of Section (s) of this rule be modified, effective August 1, 1940, as follows:

*Proposed Form:* (s-3) Stenciling: Date built new, month and year, or badge plate giving this information, required on all cars. Date rebuilt, in addition to date built new, month and year, or badge plate giving this information, required on all cars rebuilt on or after July 1, 1928. From owners. In event tank and underframe of tank cars are built at different times each must bear distinctive dates, the date on underframe to be date *underframe (including trucks) was built new.*

*Reason:* To harmonize with change in Paragraph A-5 of Rule 112.

## Rule 4

The committee recommends that a new second sentence be added to Paragraph (a) of this rule, effective August 1, 1940, to read as follows:

(a) In the case of damage to a car for which the delivering line is responsible, such line must, at the first available inspection point, attach defect card to cover. *Car owner should repair such defect-carded defects and remove defect car the first time car is shopped to car owner's repair track or repair shop.* On cars extensively damaged, etc. (no other change).

*Reason:* Defect card damage should be repaired promptly.

The committee recommends that second paragraph of Section (b) and third paragraph of Section (f) of this rule be modified, effective August 10, 1940, as follows:

*Proposed Form:* (b-2) If cars are offered in interchange with damage other than referred to in Paragraph (b-1), on which there is conclusive evidence of unfair usage, the receiving line shall require that defect card be attached to car, per Rules 2 and 14. Damage to or beyond extent specified in Sections (c) to (h), inclusive, *except when due to corrosion,* will be classified as unfair usage for which defect card shall be issued in interchange.

(f-3) Metal side and end sheets: Holes through the thickness of the metal to an extent exceeding three inches measured in any direction, except when due to shifting of loads from within the car.

*Reason:* To clarify the intent. Damage due to corrosion should be owner's responsibility.

The committee recommends that Paragraph (2) of Section (c) of this rule be modified, effective August 1, 1940, to read as follows:

(c-2) Metal posts, metal braces and metal sheets: Bent inwardly 1½ inches or more. Bulb portion only of pressed steel parts, or flanges only of structural *or pressed steel* shapes, when bent, regardless of extent, will not be cardable except where necessary to repair under conditions referred to in Paragraph (3).

*Reason:* Flanges of pressed steel parts are entitled to same protection as flanges of structural shapes.

The committee recommends that a new last sentence be added to first note following Section (d) of this rule, effective August 1, 1940, to read as follows:

*Note.*—It is understood that adjoining raked sheathing if not split or broken will not be cardable unless raked into tongue, except that on refrigerator cars sheathing boards raked to bottom of bead but not into tongue will also be cardable if they adjoin (in consecutive order) the board raked into tongue, broken or split. Sheathing damaged due to use of bar for closing side door is not cardable. *Damaged or missing short sheathing boards under doorway are not cardable.*

*Reason:* These defects are not considered detrimental and frequently do not result from unfair usage.

The committee recommends that Paragraph (1) of Section (f) of this rule be modified, effective August 1, 1940, to read as follows:

(f-1) Metal posts, metal stakes, metal braces, metal top chord angles, or their substitutes: Bent inwardly four inches or more. Bulb portion only of pressed steel parts, or flanges only of structural *or pressed steel* shapes, when bent, regardless of extent, will not be cardable except where necessary to repair under conditions referred to in Paragraph (2).

*Reason:* Flanges of pressed steel parts are entitled to same protection as flanges of structural shapes.

The committee recommends that a new second note be added to Paragraph (6) of Section (f) of this rule and issued in the next supplement, to read as follows:

*Note.—Bent metal side and end sheets are cardable only when bent in connection with cardable bent posts, stakes, braces, metal top chord angles, or their substitutes.*

*Reason:* To clarify the intent.

The committee recommends that first and second paragraphs of Section (k) of this rule be modified as follows:

*Proposed Form:* (k) (1) When a car is received home with unfair usage defects covered by defect card bearing notation "Home for Repairs," and it develops that there are associated defects due to unfair usage which evidently occurred at same time, joint inspection *as outlined in Rule 12,* may be made within 90 days after first receipt of car home, and joint inspection certificate issued showing list of defects covered by the defect card as well as list of additional associated unfair usage defects. Such joint inspection certificate shall be forwarded to the road issuing defect card which shall issue additional defect card to cover.

(2) When a car is received home covered by defect card not bearing notation "Home for Repairs," and it develops there are associated, concealed defects due to unfair usage (except interior fire damage per Rule 32, Section k), which evidently occurred at same time, joint inspection *as outlined in Rule 12,* may be made within 90 days after first receipt of car home, and joint inspection certificate issued showing list of defects covered by the defect card as well as list of the additional associated concealed unfair usage defects. Such joint inspection certificate shall be forwarded to the road issuing defect card which shall issue additional defect card to cover.

*Reason:* To harmonize with the provisions of Rule 12.

## Rule 9

The committee recommends that a new requirement be added to this rule, effective August 1, 1940, with respect to information which must appear on billing repair cards, opposite heading "General," to read *"Empty or loaded car."*

Also, that the billing repair card forms (pages 267 and 268) be revised to include space for showing this information in upper right-hand corner.

*Reason:* This information is necessary in connection with revision of Rule 1.

## Rule 16

The committee recommends that first paragraph of this rule be modified, effective August 1, 1940, as follows:

*Proposed Form:* Rule 16. Any car having defects which render it unsafe, may be repaired, subject to provisions of Rule 1.

*Reason:* To harmonize with revised Rule 1.

## Rule 17

The committee recommends that a new Note 7 be added to the brake beam substitution table under Section (e) of this rule, to read as follows:

*Note 7.—Insofar as substitutions, charges and credits are concerned, the No. 4 brake beam shall take the status of the No. 3 beam.*

*Reason:* It is considered the No. 3 beam is ample in strength and can consistently be classified as a proper substitute for the No. 4 beam.

The committee recommends that present Section (k) of this rule be relocated as new Section (l); also, that a new section to be designated as Section (k) be added, to read as follows:

*Proposed Form:* (k) *In the application of running boards, a difference in width of ¼ in. (plus or minus) from that standard to car, will be considered as proper repairs, providing the boards applied do not violate safety appliance requirements.*

*Reason:* Due to shrinkage and account of variations in com-

mercial widths as purchased from the manufacturer, it is felt this tolerance should be permitted.

## Rule 19

The committee recommends the effective date for tenth item under this rule, now set at January 1, 1941, be extended for one year, to read as follows:

Welded cast-steel truck side frames having "T" or "L" section compression or tension members, on and after January 1, *1942.*

*Reason:* To harmonize with extension recommended under Rule 3.

## Rule 20

The committee recommends that Paragraph (f) of this rule be modified, effective August 1, 1940, as follows:

*Proposed Form:* (f) *When coupler within prescribed height limits is found to be drooping (one inch or more with key attachment, or ¾ inch or more with riveted attachment), same should be corrected as provided in Paragraph (b). Coupler droop is the distance which center face of line of coupler butt.* When couplers or draft gears are removed, replaced or renewed for or on account of repairs, and coupler height is within prescribed limits, the couplers and draft gears should be properly aligned as provided in Paragraph (b).

*Reason:* To provide for alignment of drooping couplers when coupler is not below prescribed minimum height from top of rail. This recommendation has the concurrence of the Committee on Couplers and Draft Gears.

## Rule 22

The committee recommends that a new first paragraph be added to this rule, to read as follows:

Rule 22. *Damaged longitudinal sills, or parts thereof, must be repaired, or spliced, in accordance with the following specifications where practical and more economical than renewal. In such cases, if sills or parts thereof are renewed, charge may not exceed the cost of splicing.*

*Reason:* To confine repairs to minimum expense necessary in accordance with recognized general practice.

## Rule 23

The committee recommends that effective date of requirement prohibiting the welding of cast-steel truck side frames having "T" or "L" section compression or tension members, now set at January 1, 1941, be extended to January 1, 1942.

*Reason:* To harmonize with extension recommended under Rule 3.

## Rule 44

The committee recommends that this rule be revised as follows:

*Proposed Form:* (2) Composite *wood* and steel underframe cars. When five or more steel or *wood* longitudinal sills are damaged *within the space between bolsters,* providing three or more are broken entirely new at point of breakage.

(3) All-steel underframe cars having but one steel center *sill. When broken wholly or in part within the space between bolsters, or* when bent *within such space* in excess of 2½ inches. *Where failure of such sill is* due to progressive fracture back of body bolster, or failure of cast-steel extension (draft arm), *it will be owner's responsibility.*

(4) All-steel underframe cars having two or more longitudinal sills.—When two center sills, *within the space between bolsters are:*

(*a*) *Both broken wholly or in part, or*

(*b*) *When each is bent in excess of 2½ inches, or*

(*c*) *When one is broken wholly or in part, and the other is not broken but is bent in excess of 2½ inches.*

(5) (Vacant.)

Note A. Draft members, wood or steel, extending from end sill to end sill and used to reinforce center sills, are not longitudinal sills.

*Note B. The bending of steel center sills in excess of 2½ inches does not refer to sagging or bowing, but to definite buckling or abrupt bends. The term "between bolsters" means from rear edge of body bolster at one end of car to rear edge of body bolster at opposite end of car.*

*Note C.* When the damage is confined to the steel center sills within the space from end sill to bolster, car owner will be responsible, providing after investigation it is found that car was not subjected to unfair handling as provided by Paragraphs (a), (b), (c), (e), (f), (o), or (q) of Section (10) of Rule 32.

*Reason:* To provide a more explicit definition of the defects and a more practical method of determination in interchange inspection.

## Rule 49

The committee recommends that last sentence of Section (a) of this rule be relocated as new Section (b) and revised, present Sections (b), (c), and (d) to be relettered as Sections (c), (d) and (e), as follows:

*Proposed Form:* (b) Where receptacle is used, same should be in accordance with A. A. R. Recommended Practice specifications, applied one per car, preferably located *on outside of car as specified in following Paragraphs (1), (2) and (3), not more than 5 ft. 6 in. from top of rail. However, if located underneath the car, it should be applied on cross bearer nearest center of car, not more than 12 inches from side sill. Cars having fish belly side sills should not have the receptacle underneath the car.*

Present paragraphs (1), (2) and (3) of Section (a) to be relocated as paragraphs (1), (2) and (3) under new Section (b).

Present Sections (b), (c) and (d) to be relocated as new Sections (c), (d) and (e).

*Reason:* To definitely prescribe location for defect card receptacle, in order to conserve time in transportation yards.

## Rule 60

The committee recommends that air brake markings be modified to show *reporting marks* instead of *initials* of roads, by eliminating the word *"road"* shown on the cylinder in cuts on pages 122 and 123 and changing caption to read "Stencil here *reporting marks* of road" instead of "Stencil here *initials* of road."

*Reason:* To reduce stenciling. This recommendation is concurred in by the Committee on Brakes and Brake Equipment.

The committee recommends that a new Paragraph (n) be added to this rule, effective August 1, 1940, to read as follows:

(*n*) *Charge for cleaning of AB type freight brake equipment within time limits specified by this rule, is not permissible account renewal of pipe and pipe fittings, duplex release valve parts shown in Item 27 of Rule 111, vent protector, brake cylinder, brake reservoir, combined dirt collector and cut-out cock, branch pipe tee, retaining valve, or parts of these items. Charge for separate COT&S of emergency or service portion is not permitted.*

*Reason:* COT&S of operative AB brake equipment is unnecessary in connection with renewal of above items. This recommendation has the concurrence of the Committee on Brakes and Brake Equipment.

## Rule 75-A

The committee recommends that first paragraph of this rule be modified in the next supplement, as follows:

*Proposed Form:* Rule 75-A. Combination tread defects—shelled out, flat spots, brake burn comby spots: Cast-iron wheels having *three* or more defects not more than three inches apart and extending circumferentially on tread for a distance of 12 in. or more, etc.

*Reason:* To clarify the intent.

## Rule 78

The committee recommends that second paragraph of this rule be modified as follows:

*Proposed Form:* Rim, broken—cast-iron and cast-steel wheels: (a) If the width of tread measured from flange at a point ⅝ in. above tread, is 3½ in. or less (see Fig. 5); or, (b) If width of tread, measured from flange at a point ⅝ *in.* above tread, is *3¾ in. or less* and the fracture through rim inclines inwardly

toward plate (see Fig. 5-A). Measurements to be made with gage shown in Fig. 1, and applied as shown in Figs. 5 and 5-A. See Paragraph 115 and Figs. 97 to 99 in Wheel and Axle Manual.

*Reason:* To clarify the intent and harmonize with Rule 82 as recommended by the Committee on Wheels.

### Rule 98

The committee recommends that first sentence of Paragraph (5) of Section (c) of this rule be modified as follows:

*Proposed Form:* (c-5) Serviceable experimental cored hub wheels marked "A. A. R. X." when removed from service on account of defect in axle or mate wheel, shall be credited as scrap except when removed on account of Rule 32 *or Rule 84* condition in which event second-hand credit must be allowed for such undamaged wheel *or wheels.*

*Reason:* Car owner is entitled to protection in cases of wheels removed due to cut journals.

### Rule 104

The committee recommends that Item 11—Journal Boxes under Section (1) of this rule be eliminated, Item 16 reading "Truck sides" be modified to read "Truck sides, U section," and last paragraph and note be relocated as new notes under new Section (m) and modified; the new section and notes to read as follows:

*(m) The following items of material, when applied in repairs to owner's defects or on authority of defect card, must, if secondhand, be charged at 30 per cent of gross value new, less credit for part removed:*

*1. Journal boxes.*

*2. Truck sides, "T" and "L" section.*

Note 1.—When items *specified in Sections (l) and (m)* are applied, the billing repair card must show whether new or secondhand. If secondhand, the material charge must be shown in "net price" column on billing repair card. If defect card covering labor and secondhand material is issued account of wrong repairs to owner's defects, in the correction thereof bill on authority of defect card must be confined to secondhand value, regardless of whether new or secondhand material is applied. Such defect cards should so specify if secondhand material is applied.

Note 2.—Where Rule 101 quotes net price, 50 per cent of such net price *for items in Section (l), and 30 per cent for items in Section (m),* shall be used and no credit allowed for scrap.

*Reason:* Due to elimination of arch bar trucks and accumulation of journal boxes as result thereof, and obsolescence of the "T" and "L" section side frames, it is felt the charge for such secondhand parts should be reduced.

### Rule 108

The committee recommends that 23rd item under Section (a) of this rule (which prohibits labor charge) be modified as follows:

*Proposed Form:* Release lever bracket or support, straightened on car.

*Reason: No charge is now permitted for straightening release lever bracket support. It is felt the same principle should consistently be extended to cover the release lever bracket.*

### Rule 112

The committee recommends that Paragraph 5 of Section A of this rule be modified, effective August 1, 1940, as follows:

*Proposed Form:* A-5. Age of car shall be determined by subtracting year and month in which car was originally built, or rebuilt, from year and month in which car was destroyed, which will give the life in years and months. No fractional part of a month shall be considered. The age of trucks shall be the same as that of the car body. *However,* where new or secondhand tank is applied to a tank car subsequent to original date car was built; *or secondhand tank is applied to complete new underframe (including attachments) and complete new trucks (except that the following items of secondhand material may be used; couplers, draft gears, wheels, axles and AB brakes exclusive of pipe and pipe fittings), and providing that car complete including secondhand details conforms with all A. A. R. interchange requirements for new cars in effect at date of construction;* depreciation on such tank shall be computed from date tank was built new, and depreciation on remainder of car shall be computed from date *underframe (including trucks) was built new.*

*Reason:* Effective August 1, 1939, Rule 112 was modified to provide separate depreciation for tanks renewed on existing underframes and trucks. The same principle should consistently be extended to the reverse operation.

### Defect Card Form

The committee recommends that the words *"Must not have carbonized back" be added to the defect card form on page 260, similar to the billing repair card form.*

*Reason:* The use of the carbonized back is objectionable for filing purposes. As a measure of economy and to promote uniformity.

## Passenger Car Rules

### Rule 4

The committee recommends that the effective date of second paragraph of this rule, with reference to equipping all-steel or steel underframe cars with cardboards or suitable receptacle for the accommodation of defect and joint evidence cards, now set at January 1, 1941, be extended to January 1, 1942.

*Reason:* The present situation justifies this extension.

### Rule 9

The committee recommends that present note following Section (f) of this rule be eliminated and a new Section (g) added, effective August 1, 1940, as follows:

*Proposed Form:* (f) Note. (Vacant.)

(g) *(1) Air Conditioning Equipment. Labor and material expense for ice, water, lubricants, steam, fuel for internal combustion engines, and cost of precooling cars, including electric current supplied, also labor of all daily and periodic testing and inspecting and all other items of servicing.*

*Proposed Form: (2) Cost covering the above shall be agreed to by the parties involved and be charged only at the originating terminals of established line. Ice furnished ice-activated cars at intermediate terminals is also chargeable to the line.*

*(3) All repairs made are chargeable direct to car owner, including charging and flushing of batteries, and Freon or similar refrigerant supplied.*

*Reason:* The line service items enumerated are special expense of the originating terminal that should be borne by all parties to the line on a prorata mileage basis.

### Rule 10

The committee recommends that Item No. 6 of this rule be modified, effective August 1, 1940, as follows:

*Proposed Form:* Rule 10. Interchange Service expense items to be assumed by handling line, are as follows:

6. Air conditioning equipment: *Expense items outlined in paragraph (g) of Rule 9 shall be assumed by handling line.* All repairs made are chargeable *direct* to the car owner, including charging and flushing of batteries, *and Freon or similar refrigerant supplied.*

*Reason:* To harmonize with recommended revision of Passenger Rule 9.

The report was signed by W. H. Flynn (chairman), general superintendent motive power and rolling stock, N. Y. C.; J. P. Morris (vice-chairman), mechanical superintendent, A. T. & S. F.; R. G. Bennett, general superintendent motive power, Pennsylvania; A. E. Smith, vice-president, Union Tank Car Co.; J. A. Deppe, superintendent car department, C. M. St. P. & P.; L. Richardson, mechanical assistant to vice-president and general manager, B. & M.; G. E. McCoy, assistant general superintendent car equipment, C. N. R., and M. F. Covert, general superintendent of equipment, General American Transportation Corp.

In presenting the report Chairman Flynn referred to the re-

vision of paragraph 4, Section (b), of Rule 1 and presented a note defining "lower loading classification" which, he said, was to be included in the revision. The note reads as follows: "Cars of 'lower loading classification' refers to cars the general condition of which is such that extensive repairs would be required to place them in suitable condition for Class A loading. Miscellaneous minor repairs to damaged portions of flooring, roofing, sheathing, lining or doors on cars required for, and which are otherwise suitable for Class A loading, is not prohibited."

*The report was accepted.*

# Report on Labor and Material Prices

In order that the rules may currently provide an equitable basis for inter-road billing, the committee continued the work of analyzing material, labor and new equipment costs in A. A. R. Interchange Rules 101, 105, 107, 111 and 112 of the Freight Car Code, and Rules 21 and 22 of the Passenger Car Code, with a view of determining and recommending necessary changes to be made in the next supplement to the current Code.

## Freight Car Rules

### Rule 101

All miscellaneous material prices in Rule 101 were rechecked as of March 1, 1940, quotations submitted by the purchasing agents of the ten selected railroads, representing 39 per cent of total freight car ownership in the United States and Canada, showing a slight downward trend in material markets as indicated by detail recommendations for revisions shown under this rule.

The allowance of two per cent which has been added to material quotations in the past to represent interest on stock investment was based on a turnover every four months at six per cent per annum. Investigation discloses that under present conditions the more common items of car repair material are turned over every two months. It is recommended, therefore, the allowance be reduced to one per cent effective August 1, 1940, and material prices listed under this rule have been so computed.

A study is under way on nineteen selected railroads representing all portions of the United States and Canada, through the Purchases and Stores Division, to ascertain if the present ten per cent allowance for store expense used in the make-up of A. A. R. material prices, is equitable. If any modification is found necessary, revision will be made and included in the Rules effective January 1, 1941.

New Item 129-C is added, to provide charge for Type E coupler knuckle lock made of high tensile steel.

One new conditionally approved type of draft gear, Waugh-Clark 150-B, has been added to Section I of the draft gear table. One additional type has been added under the obsolete classification in Section III.

### Rule 105

Interpretation No. 1 to this rule has been modified to reduce from 15 to 12 per cent the allowance that may be added to the factory price of manufactured articles to cover store expense, interest on stock investment and freight haul, to harmonize with formula used in setting up A. A. R. material prices appearing in other rules.

### Rule 107

Based upon studies recently conducted, the allowances for bolts under Items 30 and 31, and rivets under Items 291 and 292, have been materially reduced.

New Item 47-B and note are added to provide labor charge for coupler shims described in Figs. 2 and 3 of Rule 20 and to clarify the intent that the charge for removal and replacement of couplers in order to apply any of the various types of shims shown in Rule 20 is not proper.

Items 93, 147 and 158 have been modified to clarify the intent and provide charge for drive screws and floor rack stringers.

Item 98 is modified to increase the allowance for jacking loaded cars, based on time studies in the field conducted under the direction of the committee.

Item 281 is modified to provide a more equitable allowance for annealing parts which have been welded, as result of time studies in the shops of railroads and private car lines represented on the committee.

Items 280 and 294, also as result of studies made in various railroad and private line shops, have been modified to provide a more equitable basis of charging for repairing and straightening of parts off car.

The committee has arranged to conduct time studies in the field of a number of operations, principally truck repairs, to ascertain if present allowances appearing in this rule are equitable under present day conditions on modern repair tracks. Any adjustments necessary will be incorporated in the Rules effective January 1, 1941.

### Rule 111

No modifications are recommended in this rule.

At the time studies were conducted on which the present allowance for AB brake equipment was formulated, investigation was necessarily confined to the initial cleaning operation. The second cleaning cycle has now been reached for a considerable number of such brakes, which undoubtedly will involve the renewal of an increased number of detail parts. Arrangements have been made to conduct studies on various railroads of the cleaning operation, to include a reasonable percentage of brakes due for second cleaning, and any adjustment necessary will be made in the 1941 Code.

### Rule 112

Recommendations are made in this rule respecting reproduction pound prices of new freight cars of all classes, in order that Supplement of August 1, 1940, may reflect 1939 costs in lieu of figures shown in the present Code. New prices recommended are based on costs of 16,889 freight cars constructed during the year 1939.

The table listing all-steel tank cars has been modified to provide a more definite separation between insulated and non-insulated tank cars, and inclusion of the higher pressure requirement cars with other special types to be settled for on reproduction cost basis.

## Passenger Car Rules

### Rule 21

Item 26 modified and first note following eliminated to provide an allowance for turning wrought-steel and steel-tired wheels equipped with certain types of roller bearings which necessitate additional work in order to perform the operation.

### Rule 22

Material prices were rechecked on basis of quotations as of March 1, 1940, showing a slight downward trend as indicated by detail recommendations for revisions shown under this rule.

Note following Item 49 modified to clarify the intent.

It is the intent of the committee to investigate labor and material costs again in October and if sufficient change develops, necessary revisions will be made and inserted in the rules effective January 1, 1941.

[The changes recommended in the existing rules are shown in detail in the report.]

## Supplementary Report

[Note: This supplementary report, presented at the time of the meeting, not only recommends additional changes but alters, in some respects, the recommendations of the original report, as abstracted above—Editor.]

As a result of time studies just completed on five railroads in sufficient volume to warrant modification of a number of labor allowances, your Committee recommends additional changes in Rules 101, 107, 111 and Passenger Rule 21.

### Freight-Car Rule 101

The labor allowance for renewal of dust guards has been absorbed in the allowances for wheels, truck sides and journal

boxes. Accordingly, the wording of Item 169-A is modified to indicate an applied price and the labor allowance in Rule 107 eliminated.

### Freight-Car Rule 107

Item 20 covering renewal of brake beams, is modified, and new Item 20-A added, to provide separate allowances for beams renewed separately versus those renewed in connection with truck bolster, truck side or wheels in unit type trucks, which it is felt will provide a more equitable method of charging.

Item 102 covering labor charge for journal box dust guards is eliminated, account labor absorbed in the allowances for wheels, truck sides and journal boxes.

Items 239, 240, 241 and 265 covering stenciling operations are clarified, allowances modified and the latter two items relocated as news Items 240-A and 241.

Item 256 covering renewal of truck springs, caps or shims, has been modified to include necessary jacking for this operation and separate allowances set up for empty and loaded cars.

Based upon the studies recently conducted, in addition to the above mentioned items, modifications are recommended in the allowances under Items 14, 42, 43, 44, 45, 48, 49, 138, 143, 153, 254, 255, 267, 268, 269, 270 and truck combination labor charges under Items 317 to 325 inclusive.

### Freight-Car Rule 111

Based upon studies recently conducted, which included a representative number of valves undergoing second period attention, the allowance in Item 15 for COT&S of AB freight brake equipment is materially reduced.

### Passenger-Car Rule 21

Item 25-B is modified to reduce allowance to be deducted when wrought-steel wheels are removed and dismantling operation is unnecessary.

The report was signed by A. E. Calkins (chairman), superintendent of equipment, N. Y. C.; A. E. Smith (vice-chairman), vice-president, Union Tank Car Co.; J. D. Rezner, general car foreman, C. B. & Q.; P. Kass, superintendent car department, C. R. I. & P.; T. J. Boring, general foreman, M. C. B. Clearing House, Pennsylvania; H. H. Boyd, assistant chief motive power and rolling stock, Can. Pac., and A. H. Gaebler, superintendent car department, General American Transportation Corp.

*The report was accepted.*

## Report on Specifications for Materials

During the past year this committee has reviewed the material specifications, giving consideration to comments and criticisms submitted by the members of the association, and others.

The following revisions are submitted for your consideration:

*1—Specifications M-102-34, forgings carbon steel, annealed and unannealed.*—In order to clarify interpretation, changes to be made as follows: Page 1, Sec. 1. Scope.—(a). Last sentence to be revised as follows: "Grade 3 forgings are generally used for locomotive axles, side rods, crank pins, guides, etc." Page 1, Sec. 1. Scope.—(c). To be revised as follows: "Unless otherwise specified, Grades 1 and 2 forgings will be furnished unannealed, and Grade 3 forgings will be furnished annealed." Page 2, Sec. 7. Chemical Composition—Grade 3 requirement for Manganese: change 0.50—0.90 per cent to 0.60—0.90 per cent.

*2—Specifications M-108-37, boiler tubes, lap-welded and electric resistance welded seamless steel and lap-welded charcoal iron.*—This specification has been revised as a whole, and the recommended revised specification is identified as Exhibit A (not shown in the present abstract of the committee's report). The principal changes are as follows: (a) To conform to present practice in the steel industry, the tables have been modified on the basis of wall thickness expressed in decimals of an inch in place of Birmingham wire gage. (b) At the recommendation of the Committee on Locomotive Construction, the scope of the specifications has been changed to include dry pipes and steam pipes for locomotives, to dimensions shown in Table II, to replace the figures for dry pipes shown in the Manual, Sec. F, page 6A, 1924.

*3—Specifications M-109-36, structural rivet steel and structural rivets.*—Specifications M-110-36, boiler rivet steel and boiler rivets. Consolidation of specifications M-109 and M-110 is recommended and draft of the proposed consolidated specification, designated as M-110-40, is identified as Exhibit B (not included in this abstract of the committee's report).

*4—Specifications M-119-34, galvanized sheets.*—Changes to be made as follows: Page 2, Sec. 5 (c) Table I. Insert U. S. standard gage No. 15; nominal thickness of base sheet, .070 in.; weight of galvanized sheet, ounces per sq. ft., 45.1 min., 47.5 nominal, 49.9 max.; minimum weight of coating, 1.75 ounces per sq. ft.

*5—Specifications M-302-37, refined wrought iron bars.*—Changes to be made as follows: Page 2, Sec. 5 (a): Heading of second column to be changed to read "Round, Square and Hexagonal Bars 1⅝ in. and up to but not including 2½ in. in diameter or thickness." Add small letter "c" in third column opposite tensile strength requirements for both Grades A and B. Change present footnote reference "a" to read, "Bars from ½ in. to ⅞ in. in diameter will be accepted if the elongation in 8 in. is not less than 25 per cent for Grade A, or 22 per cent for Grade B material"; and add additional sentence to footnote reference "a" to read: "Bars under ½ in. in diameter will be accepted if the elongation in 8 in. is not less than 22 per cent for Grade A and for Grade B material." Add footnote reference "c" to read, "c When the sectional area exceeds 12 sq. in. the allowable minimum tensile strength shall be 45,000 lb. per sq. in."

*6—Specifications M-603-38, hose, air, gas and oxygen, wrapped and braided.*—Changes to be made as follows: Page 4, Sec. 15 (b) to be revised as follows: "(b) For braided hose, the inside diameter may vary either way from that specified by not more than 3/128 in. for the ¼ in. size; 1/32 in. for sizes larger than ¼ in. up to and including ¾ in.; and by not more than 1/16 in. for larger sizes."

*7—Specifications M-904-36, renovated car oil.*—This specification as submitted by the Joint Sub-Committee on Journal Box Lubricating Materials has been studied and approved, and it was agreed that the Committee on Lubrication should include it in that committee's annual report.

This committee recommends that the above revisions in specifications be approved for submission to letter ballot.

The report was signed by T. D. Sedwick (chairman), engineer of tests, C. R. I. & P.; E. E. Chapman (vice-chairman) mechanical assistant, A. T. & S. F.; Frank Zeleny, engineer of tests, C. B. & Q.; H. G. Burnham, engineer of tests, Nor. Pac.; H. P. Hass, engineer of tests, N. Y., N. H. & H; J. R. Jackson, engineer of tests, Mo. Pac.; H. G. Miller, engineer of tests, C. M. St. P. & P.; J. W. Hergenhan, assistant engineer, test department, N. Y. C.; L. B. Jones, engineer of tests, Penn.; C. B. Bryant, engineer of tests, Southern; and W. R. Hedeman, engineer of tests, B. & O.

*The report was accepted and submitted to letter ballot.*

## Locomotive Construction

### Design of Fundamental Parts of Locomotives

#### Wheel Centers of the Thin Wall Type

The Committee decided to continue report made last year and show defects that have developed in the various types of wheel centers.

Report following shows all defects from date of application up to April 30, 1940. This information is given for the benefit of member roads as well as benefit of manufacturers in dis-

**Table I—Summary of Failures of Thin-Wall Driving Wheel Centers**

| Manufacturer | Total number of wheels in service | Total defective | Per cent Defective |
|---|---|---|---|
| No. 1 | 1,086 | 77 | 7.0 |
| No. 2 | 8,499 | 52 | .61 |
| No. 3 | 340 | 11 | 3.2 |
| No. 4 | 1,267 | 17 | 1.3 |
| No. 5 | 833 | 4 | .48 |

covering defects in designs and making necessary corrections for overcoming same.

[The report includes tabular details of failed wheel centers. A summary of such failures appears in Table I—EDITOR.]

### MULTIPLE BEARING CROSSHEADS

The sub-committee was requested to prepare proposed designs to be added to the Manual as recommended practice for multiple bearing crossheads.

Two different designs are shown in the report and it is the intention of the committee to have both placed in the Manual so that individual roads can select the type desired.

It is recommended that this be submitted to member roads by letter ballot for inclusion in the Manual as recommended practice.

### FURNACE AND FIREBOX SUPPORT AND BOILER WASTE SHEETS

In 1938 a test was made jointly by the Baldwin Locomotive Works and the General Steel Castings Corporation on a locomotive then under construction in the Baldwin plant having one-piece cast-steel bed. This test was made to determine the effect of waist sheets or other attachments between frame and boiler from the front of the firebox to smoke box connection.

The sub-committee went over report of this test and for the information of member roads we are quoting below conclusions reached by the Baldwin Locomotive Works and General Steel Castings Corporation as result of this test:

"The waist sheet bearer at the guide yoke results in a high reaction downward through the sheet which gives a peak in the bending moment curve at this point. From the diagram it does not appear that this waist sheet is contributing much to the vertical resistance.

* * *

"The final conclusions reached are that it does not appear that eliminating all connections between frame and boiler from firebox to smoke box saddle is advisable. It is therefore suggested that a single boiler bearing located midway between cylinders and front furnace bearer, say between main and intermediate drivers, would offer maximum support to vertical deformations and minimize the stresses in the region immediately rear of the cylinders. The bearing should have sufficient rigidity to withstand vertical impact without yielding, at the same time provisions should be made for longitudinal expansion of the boiler. This could be obtained with a sliding shoe bearing which would offer a large bolting flange to cradle the boiler and provide a low unit pressure on the sliding surface, insuring positive resistance at all times."

One member road built some locomotives in 1937, others in 1939, with a single boiler support midway between cylinders and front furnace bearer. Another road is now rebuilding some locomotives with a single support.

## Exhaust Steam Injectors and Exhaust Steam Feedwater Heaters

The sub-committee has continued the study of exhaust steam injectors and in addition exhaust steam feedwater heaters and was instructed to submit informative report covering reliability, maintenance, service, etc., of both, the exhaust steam injectors and exhaust steam feedwater heaters.

Manufacturers of respective equipment advised the application of their product to locomotives in the United States and Canada as follows:

| | | |
|---|---|---|
| Exhaust steam injectors | 1,200 | (2 mfgrs.) |
| Exhaust steam feedwater heaters, closed heater, pump type | 5,160 | (2 mfgrs.) |
| Exhaust steam feedwater heaters, open heater, pump type, including turbo injectors | 3,893 | (3 mfgrs.) |
| Total | 10,253 | |

In response to a questionnaire sent out by the secretary, soliciting information to develop comparative reliability, maintenance and service data from roads using above injectors or heaters, replies were received from 36 railroads on injectors and from 53 railroads on heaters. Most railroads reported in detail as requested, only a few stating that no information was available.

All types of devices as reported employ exhaust steam for raising temperatures of the boiler feedwater. In the open-type heater, the condensed exhaust steam forms a part of the boiler feed, same as the exhaust steam injector, whereas in the closed type heater, the exhaust steam does not contact the feedwater.

[The report includes statements covering results of data requested, the number of failures, delays, as well as maintenance costs, etc., being based on performance of years 1937, 1938 and 1939, as this three year period indicates the general prevailing condition.—EDITOR.]

The boiler pressure of locomotives equipped with exhaust steam injectors varied from 170 to 300 lb. per sq. in. and of locomotives equipped with exhaust steam feedwater heaters from 175 to 310 lb. per. sq. in.

As to inquiry of questionnaire reading "Has the use of exhaust steam injectors or heaters had any effect on boiler maintenance," most replies indicate that devices reported have generally not been in service a sufficient length of time to notice a definite effect while a few claim small savings on boiler maintenance with extent unknown. Also as to the inquiry, "In bad water districts is the fuel and water saving reduced because of scaling condition," replies indicate that open heaters are not affected while closed heaters are affected with extent depending on condition.

The sub-committee desires to continue its studies on the economies of the various types injectors and heaters as now used in order to develop more accurate maintenance and repair costs, differentiating between running and classified repairs, both labor and material.

The secretary will be requested to issue a questionnaire to members covering a record of such expenditures for period July 1, to December 31, 1940.

## Development and Use of Oil-Electric Locomotives

The committee on the Development and Use of Oil-Electric Locomotives has continued to assemble information as to the use of this type of equipment, has brought up to date all information previously assembled by adding thereto units placed in service during the year 1939, and has also included in the report a statement showing those units on order as of January 1, 1940.

On December 31, 1939 there were 749 Diesel units in operation. 250, or approximately 33 per cent of the total were placed in service during the year 1939 by 52 railroads and operating companies. The installations during that year exceeded the installations of any previous year by 61 per cent.

Our study also developed that up to and including the 1939 report there were 122 railroads and operating companies operating Diesel locomotives as compared with 99 as of December 31, 1938, an increase of 23, and as a further indication of the extended use of this equipment during the year 1940, the committee found that on January 1, 1940 there were 57 Diesel locomotives on order for 16 railroads and operating companies.

The previous report of the Committee indicated that there were 23 units of 2,000 hp. or larger operated in combination on various railroads, making a total combined horsepower of from 2,000 to 6,000, which units, for the purpose of this report, have been considered as one Diesel-electric locomotive, and during the year 1939 there were 21 additional Diesel locomotives in this classification placed in service.

Continuing the previous tabulation designed to show the diversified use of the Diesel locomotive, the following table indicates the number of Diesel locomotives of varying horsepower that have been placed in service prior to December 1, 1939:

| Horsepower | Delivered 1939 | Delivered Prior to 1939 | Per Cent Increase During 1939 |
|---|---|---|---|
| Less than 300 | 2 | 23 | 8.6 |
| 300 to 600 | 13 | 118 | 11.0 |
| 600 to 900 | 132 | 235 | 56.1 |
| 900 | 7 | 73 | 9.5 |
| 950 to 6,000 | 96 | 50 | 190.0 |

It is particularly noted that of a total of 250 units placed in service during the year 1939, 107 were of 600 hp. and 73 were of 1,000 hp. In previous years the 600 hp. seemed to have enjoyed the most general adoption, but during 1939 there was a

## Table II—Record of Diesel-Electric Locomotive Operation and Maintenance Cost of Selected Railroads for a Six Months' Test Period

| Railroad index | No. of units | Hours assigned | Hours operated | Per cent of assignment operated | Gallons lub. oil | | Gallons fuel oil | | Cost of Repairs | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Total | Per hour | Total | Per hour | Electrical equipment | | Diesel equipment | | Total | Per loco. hour |
| | | | | | | | | | Labor | Material | Labor | Material | | |
| 600 hp. | | | | | | | | | | | | | | |
| 1 | 4 | 16,748 | 16,748 | 100.00 | 1,307 | .0780 | 98,602 | 5.887 | $772.70 | $204.18 | $2,382.40 | $834.08 | $4,193.26 | .2504 |
| 2 | 6 | 24,736 | 24,347 | 98.43 | 4,483 | .1841 | 133,567 | 5.486 | 508.94 | 18.01 | 2,732.25 | 1,931.80 | 5,369.12 | .2205 |
| 3 | 29 | 121,975 | 115,504 | 94.69 | 15,181 | .1314 | 589,177 | 5.101 | 2,853.10 | 907.07 | 8,295.00 | 4,387.84 | 19,705.12 | .1706 |
| 4 | 5 | 20,527 | 19,029 | 92.70 | 2,622 | .1378 | 91,120 | 4.788 | 1,193.02 | 451.04 | 1,588.16 | 1,569.36 | 7,195.72 | .3781 |
| 5 | 14 | 61,152 | 39,989 | 65.39 | 7,122 | .1781 | 322,620 | 8.068 | 4,301.06 | 413.91 | 9,772.10 | 5,083.78 | 28,940.08 | .7237 |
| 6 | 6 | 26,208 | 22,073 | 84.22 | 2,138 | .0969 | 126,045 | 5.710 | * | * | * | * | 6,663.07 | .3019 |
| 7 | 3 | 12,545 | 11,814 | 94.17 | 1,502 | .1271 | 62,040 | 5.251 | * | * | * | * | 4,648.00 | .3934 |
| 8 | 4 | 15,472 | 13,364 | 86.38 | 1,202 | .0899 | 56,738 | 4.246 | * | * | * | * | 3,139.51 | .2349 |
| TOTAL | 71 | 299,363 | 262,868 | 87.81 | 35,557 | .1353 | 1,479,909 | 5.630 | $9,628.82 | $1,994.21 | $24,769.91 | $13,806.86 | $79,853.88 | .3038 |
| Average | .. | 4,216 | 3,702 | 87.81 | 501 | .1353 | 20,844 | 5.630 | ..... | ..... | ..... | ..... | 1,124.70 | .3038 |
| 900 hp. | | | | | | | | | | | | | | |
| 2 | 3 | 8,332 | 7,903 | 94.85 | 1,680 | .2126 | 62,283 | 7.881 | $151.03 | $234.85 | $1,153.44 | $1,025.99 | $2,578.29 | .3262 |
| 3 | 8 | 34,101 | 31,942 | 93.67 | 4,255 | .1332 | 188,002 | 5.917 | 1,524.86 | 312.21 | 2,738.80 | 481.75 | 6,229.18 | .1950 |
| 4 | 3 | 12,529 | 11,869 | 94.73 | 1,664 | .1402 | 81,159 | 6.838 | 913.21 | 117.87 | 2,407.21 | 2,101.98 | 6,373.15 | .5370 |
| 9 | 2 | 8,056 | 7,745 | 96.14 | 2,172 | .2804 | 53,778 | 6.944 | 150.34 | 13.59 | 637.93 | 1,505.69 | 3,076.93 | .3973 |
| 10 | 2 | 8,736 | 8,254 | 94.47 | 2,279 | .2761 | 63,918 | 7.744 | * | * | * | * | 2,017.79 | .2445 |
| 6 | 9 | 39,312 | 34,049 | 86.61 | 4,296 | .1262 | 198,210 | 5.821 | * | * | * | * | 7,757.55 | .2278 |
| TOTAL | 27 | 111,066 | 101,762 | 91.62 | 16,346 | .1606 | 648,350 | 6.371 | $2,739.44 | $678.52 | $6,937.38 | $5,115.41 | $28,032.89 | .2755 |
| Average | .. | 4,114 | 3,769 | 91,62 | 605 | .1606 | 24,013 | 6.371 | ..... | ..... | ..... | ..... | 1,038.26 | .2755 |

* Information not available.

decided trend toward 1,000 hp. units; 73 being placed in service, whereas prior to 1939 only 4 of this horsepower were in use.

[The report includes two tables showing the Diesel locomotives in service, classified by year and horsepower over a 15-year period, and by class of service.—EDITOR.]

During the year the railroads were canvassed in an effort to assemble information as to availability, lubrication and fuel oil consumption, cost of repairs and with special request to distribute the cost of repairs between electrical and Diesel equipment. From the reports of ten selected railroads the results of this six months operation on seventy-one 600 hp. Diesel-electrics and twenty-seven 900 hp. Diesel-electrics are tabulated on Table II. This table is of interest since it shows the variation in cost between various railroads and the average combined total for the railroads in each group.

The locomotives considered are of various ages and there is a considerable number of recent construction included, which, in part, accounts for the variation in maintenance costs, but the information reference availability, lubricating and fuel oil performance shows less variation and indicates what the railroads are finding in actual operation.

A question has been raised with reference to the relation of the cost of maintaining the electrical and Diesel equipment. For the 600 hp. units it was developed that the cost of maintaining the electrical equipment is approximately 18 per cent of the total and this expense is divided about 82 per cent labor and 18 per cent material. The cost of maintaining the Diesel equipment is approximately 59 per cent of the total and this expense is divided about 65 per cent labor and 35 per cent material. With the 900 hp. units there was a slight variation in the percentages, although this is undoubtedly due to the variation in the average age of the units considered.

Attention is directed to the total hours operated for six months period by the seventy-one 600 hp. units. 3,702 hours per unit during this period is 87.81 per cent of the continuous assignment of 24 hours per day and represents 20.2 hours actually operated each calendar day, which is an indication of the availability of this equipment.

The information as to estimated cost of repairs over considerable periods of operation is quite clearly set forth in the committee's 1939 report. With the additional information contained in this report as to availability, lubricating and fuel oil performance and distribution of cost of repairs between electric and Diesel equipment, it is felt that sufficient information is available to justify consideration of suspension for the present at least of activities of this committee and it is so recommended.

## Standardization of Valves for Locomotives

Since the A. A. R. Standard valves were adopted as recommended practice, the committee has endeavored to secure information as to the service rendered by the valves and the possibility of improvement in the design or the materials of which the valves are made.

In response to a questionnaire issued for this purpose, the railroads report generally that the service obtained is superior to that obtained from other than A. A. R. valves, but that some minor difficulties have been encountered, which are being given consideration by the committee.

On valves of the outside screw and yoke type, used in locations requiring frequent operation of the valve, there have been some cases of stripping of the bonnet threads, the bonnet being made of bronze and the stem of stainless steel. To overcome this difficulty and to improve the construction of the valve, the committee has developed the design of bushing with locknut for application in the bonnet as shown on Pages F-174A, 174B and 174C, which is now submitted as recommended practice for new or repaired bronze O. S. & Y. type valves.

The material specification has been revised to include this bushing and locknut, and also to increase the Brinell hardness

## Table III—Applications of Roller Bearings in the United States and Canada

| | Timken | SKF | ASF | Hyatt | Fafnir | All |
|---|---|---|---|---|---|---|
| Total engine trucks equipped | 556 | 489 | 87 | 0 | 0 | 1,132 |
| Total main drivers equipped | 387 | 63 | 0 | 0 | 0 | 450 |
| Total other drivers equipped | 387 | 51 | 0 | 0 | 0 | 438 |
| Total all drivers equipped | 387 | 44 | 0 | 0 | 0 | 431 |
| Total trailer trucks equipped | 309 | 120 | 100 | 0 | 0 | 529 |
| Total tender trucks equipped | 495 | 279 | 176 | 10 | 9 | 969 |
| Total eng. trk. bearings applied | 2,084 | 1,926 | 348 | 0 | 0 | 4,358 |
| Total main driver bearings applied | 850 | 146 | 0 | 0 | 0 | 996 |
| Total other driver bearings applied | 2,366 | 232 | 0 | 0 | 0 | 2,598 |
| Total all driver bearings applied | 3,216 | 378 | 0 | 0 | 0 | 3,594 |
| Total trailer trk. bearings applied | 1,118 | 494 | 390 | 0 | 0 | 2,002 |
| Total tender trk. bearings applied | 5,896 | 3,420 | 2,112 | 116 | 108 | 11,652 |
| Per cent of total eng. trk. bearings applied | 47.82 | 44.194 | 7.985 | 0 | 0 | ..... |
| Per cent of total main driver bearings applied | 85.341 | 14.658 | 0 | 0 | 0 | ..... |
| Per cent of total other driver bearings applied | 91.07 | 8.92 | 0 | 0 | 0 | ..... |
| Per cent of total trk. bearings applied | 55.844 | 24.675 | 19.48 | 0 | 0 | ..... |
| Per cent of total tender bearings applied | 50.60 | 29.351 | 18.125 | 0.995 | 0.926 | ..... |
| Per cent bearings reported of total number applied, e. t. | 69.481 | 64.382 | 47.126 | .... | .... | ..... |
| Per cent bearings reported of total number applied drivers | 48.569 | 95.238 | .... | .... | .... | ..... |
| Per cent bearings reported of total number applied trl. trk. | 59.391 | 71.659 | 30.769 | .... | .... | ..... |
| Per cent bearings reported of total number applied tender | 62.754 | 69.59 | 23.295 | 100.00 | 22.222 | ..... |

of the seat ring and disc on all valves from 175 to 225, which is considered more satisfactory for these parts.

The committee still has under consideration the proposed standard valves for superheated steam up to 400 lb. pressure and a temperature of 750 deg. F., but have as yet been unable to complete the assignment, pending advice from the Committee on Specifications for Materials as to the proper materials to be used for valves of this character.

## Roller Bearings for Locomotive and Tenders

The sub-committee reported in 1939 in detail on general description of methods and practices in effect relative to mounting, dismounting, inspecting, replacing, reconditioning, cleaning, lubricating, etc., of roller bearings, together with statement giving location of roller bearings on which the member roads have been reporting December 1, 1935, to June 1, 1938.

The statement in Table III has been revised including all applications up to December 1, 1939.

The sub-committee was instructed to obtain further experience of roads with regard to roller bearings and their effects upon other parts of locomotives, also develop further information as to economies of such bearing as compared with friction bearings.

Questionnaires were issued by the secretary requesting detailed information and experience of driving box, engine truck, trailer truck, tender truck, side and main rod, valve gear and miscellaneous application of roller bearings as of December 1, 1939.

[The report includes detailed tabulations of roller bearing applications on engine, truck, driving, trailing truck and tender axles, on side and main rods, and valve gears. The tabulations show the number of applications, total mileages made, nature and number of bearing failures and the mileages made per bearing failure.—EDITOR]

**Table IV—Relative Maintenance Costs of Friction vs. Roller Bearing Locomotives**

| Key No. | Dr. | E.T. | T.T. | Tender | Loco. maintenance costs per mile (labor and material) Per engine of classes reported: Friction | Roller | Average monthly mileage per class: Friction | Roller | Type of loco. |
|---|---|---|---|---|---|---|---|---|---|
| 3 | x | x | x | x | .2327 | .1452 | 7,754 | 15,538 | 4-6-4 |
| 6 | x | x | – | x | .2514 | .1611 | 2,055 | 6,182 | 2-10-4 |
| 6 | x | x | x | x | .1645 | .1035 | 6,062 | 9,611 | 4-8-4 |
| 10 | – | x | x | – | .... | .... | 9,950 | 10,800 | .... |
| 15 | – | x | – | – | .217 | .209 | 8,500 | 8,500 | .... |
| 18 | – | – | – | – | .186 | .130 | 4,300 | 7,600 | .... |
| 19 | Ma. | – | – | – | .... | .... | 4,700 | 6,500 | 4-6-2 |
| 21 | x | x | x | x | .1465 | .1288 | 7,350 | 8,900 | 4-8-4 |
| 24 | x | x | – | x | .... | .... | 7,000 | 7,000 | .... |
| 26 | x | x | x | x | .... | .... | 6,516 | 7,714 | .... |
| 29 | – | – | – | – | .2033 | .... | .... | .... | .... |
| 29 | – | – | – | – | .1448 | .... | .... | .... | .... |
| 29 | – | – | – | – | .1708 | .... | .... | .... | .... |
| 30 | x | x | x | – | .... | .... | 6,000 | 11,000 | 4-6-2 / 4-6-4 |
| 33 | x | x | x | x | .402 | .204 | 4,105 | 6,554 | 2-8-8-2 |
| 38 | x | x | x | x | .... | .... | 6,093 | 7,791 | .... |

Replies to questionnaire as to difference in maintenance cost (labor and material) of bearings, driving boxes, hub liners, etc., of engines equipped with roller bearings versus friction bearings, indicate that roads did not keep a record of such costs and only a few roads replied to the inquiry.

Relative to the guarantee of roller bearings as applied to locomotives and tenders, the sub-committee understands that the customary guarantee given by all roller bearing companies is as follows:

| | |
|---|---|
| 0-100,000 miles | Replace, no charge |
| 101,000-150,000 miles | Replace 20 per cent of sales price |
| 151,000-200,000 miles | Replace 40 per cent of sales price |
| 201,000-250,000 miles | Replace 60 per cent of sales price |
| 251,000-300,000 miles | Replace 80 per cent of sales price |
| over 300,000 miles | Replace 100 per cent of sales price |

As to repairing roller bearings found defective—two plans may be followed:

a—Manufacturer to repair parts involved at nominal repair charge and returning bearings for further service with no mileage credit.

b—Manufacturer to repair bearing—no charge. Bearing returned to service with a credit for mileage made to date of removal.

In either case manufacturer to decide whether to repair or to replace bearing.

All failures of roller bearings due to wrecks, or which can be shown to have been caused by neglect on the part of railroad should not be considered part of manufacturers' responsibility.

Relative to inquiry as to hot boxes experienced with roller bearings, only three roads reported hot boxes—three boxes on tenders, and three boxes on locomotives, no data being given as to reason why hot boxes occurred.

As to cost of lubrication per 1,000 miles of roller bearing equipped axles as compared with friction bearings of the same class of locomotives, nearly all roads reported "No record." The cost figures reported by a few roads, we believe, do not indicate a reliable average figure.

One road referred to above is now applying axles made of normalized and tempered manganese vanadium steel of the following chemical properties in per cent:

| | |
|---|---|
| Carbon | 0.27-0.34 |
| Manganese | 1.45-1.75 |
| Silicon | Min. 0.15 |
| Phosphorus | Not over 0.045 |
| Sulphur | Not over 0.050 |
| Vanadium | Min. 0.15 |

(Yield Point—70,000 lb. per sq. in.)

The same road is obtaining axles in accordance with A. A. R. Specification M-104-37, Class A, normalized and tempered with roller bearing surfaces cold rolled, one axle being provided with a stress relief groove for test.

One road, reporting no axle failures, uses a low-carbon-nickel steel of the following chemical properties (in per cent) for driving and trailer axles:

| | |
|---|---|
| Carbon | 0.25-0.32 |
| Manganese | 0.75-0.95 |
| Phosphorus | 0.045 |
| Sulphur | Max. 0.05 |
| Silicon | 0.15-0.35 |
| Chromium (max.) | 0.15 |
| Nickel | 2.50-3.00 |

One road, reporting no axle failures, uses a carbon vanadium steel.

## Shelling of Trailer Wheel Tires

The shelling of trailer tires is now being studied on the six railroads having the greatest amount of trouble.

During the past two years, on these six roads, there has been an increase in the application of heat-treated tires, and the data collected for the period ending October 1, 1939, indicates results have been more satisfactory with heat-treated tires than with non-heat-treated tires.

The sub-committee feels it advisable to continue this study for an additional period, in order to derive the benefit of tests now being made on the above mentioned roads with heat treated tires.

[The report included a tabulation of tire failures reported for a six-month's period ended October 1, 1939.—Editor]

## Fusion Welded Locomotive Boiler

At the Mechanical Division conventions held in June, 1937, 1938, and 1939, the Committee on Locomotive Construction submitted report on the above subject. Since these reports were submitted we now have advice that the second semi-annual inspection in the second year of service was made on November 17, 1939, at Oneonta, New York, of the boiler of D. & H. locomotive No. 1219. At this time the boiler was washed, inspected and hydrostatic test applied. Jacket and lagging was removed to inspect the welded seams. Hydrostatic test was of 350 pounds pressure and the inspection showed that the welding of the wrapper sheets and the welding of the firebox, after being carefully examined, were found to be in good condition. The locomotive

had made 134,000 miles up until that time and to that date there had not been a simmer from any of the welds.

We have a further letter from the superintendent of motive power dated April 5, 1940, in which he states that since his letter of November 22, 1939, no trouble has been experienced from this boiler and that it has not given any trouble since it was first applied to the locomotive and placed in service on September 24, 1937.

The Committee will continue to follow this matter during the period of inspection required by the Federal inspectors who specify that in the first year of service the lagging and jacket is to be removed and the joints examined each three months, in the second year each six months, and yearly thereafter for a period of five years.

## Research Program Covering Axles, Crank Pins and Bearings

[The sub-committee's report was in the nature of a summary of a complete report to be sent to the members at a later date. —EDITOR]

### INTRODUCTION

The first progress report issued in May, 1938, stated that the Committee proposed to make further study which would be confined to main crank pins only of both failed pins and pins which were found defective upon inspection. This present report is based on the analysis of information submitted in reply to a questionnaire sent to locomotive voting members, asking them to keep a record of main crank pin renewals and failures for the period November 15, 1937, to August 15, 1938.

A total of seventy-eight railroads sent information in reply to the questionnaire, reporting the ownership of 43,468 steam locomotives. A total of 1,695 main crank pins were removed from these locomotives during the above period. Switching locomotives and three-cylinder locomotives are not considered, as it was felt they were not representative of conditions under investigation. Locomotives reported as being in combination freight and passenger service are included in passenger service tabulations. Main crank pins that were stated as being bored for internal lubrication have been classed as hollow pins. Composite pins have been classed as solid pins.

### ANALYSIS OF CRANK PIN FAILURES

*Total number of main crank pin failures*—The total number of main crank pin failures on steam locomotives used in freight and passenger service is:

| | No. of Failures |
|---|---|
| Locomotives in freight service | 83 |
| Locomotives in passenger service | 68 |
| Total for 9 month's period | 151 |

*Average mileage before failures of crank pins*—The average for each class of service is:

| | Mileage |
|---|---|
| Locomotives in freight service | 165,500 |
| Locomotives in passenger service | 169,600 |
| Average mileage for all failures | 167,000 |

*Location of failure on crank pins*—An analysis of the location of failures on main crank pins shows that in both freight and passenger service more failures occurred in the wheel fit than at any other location on the crank pin. The distribution for each class of service is:

| | Percentage |
|---|---|
| **Locomotives in freight service** | |
| In wheel fit | 41.34 |
| Flush with hub face | 32.0 |
| At fillet next to hub | 18.66 |
| At side rod journal | 4.0 |
| At fillet between main and side rod; main rod journal; and eccentric fit | 4.0 |
| Total number of failures of known location on freight locomotives | 100.0 |
| **Locomotives in passenger service** | |
| In wheel fit | 54.10 |
| Flush with hub face | 18.03 |
| At fillet next to hub | 18.03 |
| At side rod journal | 6.56 |
| At eccentric fit | 3.28 |
| Total number of failures of known location on passenger locomotives | 100.0 |

*Location of crank pin failures on sides of locomotives*—More crank pin failures occurred on the left than on the right side of locomotives, although in the case of passenger locomotives for the period covered by questionnaire failures of main crank pins were evenly divided between the right and left side of the locomotives. Ratio of number of failures on left side and number on right side is:

| | |
|---|---|
| Freight locomotives | 1.31 |
| Passenger locomotives | 1.00 |
| Total combined freight and passenger | 1.16 |

*Causes of crank pin failures*—As in a previous report, the number of failures for which the railroads reported "unknown causes" or "progressive fracture" without giving a cause for these progressive fractures have been grouped together. The main causes for the different locations are:

a. The cause of 68.75 per cent of the failures in the wheel fit are reported as unknown.

b. The cause of 65.71 per cent of the failures flush with hub face are reported as unknown.

c. The cause of 36.0 per cent of the failures at the fillet next to the hub were reported as unknown.

d. The cause of 85.72 per cent of the failures in side rod journal were reported as unknown.

e. Poor machining was reported as the cause of 60.0 per cent of the failures at fillet between main and side rod, main rod journal and eccentric fit.

*Types of locomotives on which failures occurred*—Main crank pin failures are classified by types and the analysis indicates that:

1—In freight service in proportion to the number of locomotives in service, more failures of main crank pins occurred on the 4-8-4 type, although the greatest number of actual crank pin failures occurred on the 2-8-2 type.

2—In passenger service the situation is somewhat confused, owing to the number of locomotives that are commonly classified as a freight type locomotive being included in the passenger classification owing to the fact, as stated in the introduction, that where locomotives were reported as being in both freight and passenger service they were classed as passenger. In proportion to the number of locomotives in service the highest ratio of failures on the types that might be classed as commonly used in passenger service occurred on the 4-8-4, while the greatest actual number of failures occurred on the 4-6-2.

*Stresses in failed crank pins*—Fibre stresses for different crank pin materials and different locations classed by locomotive types and by service are given in four tables. The stresses were computed according to A. A. R. recommended practice. The maximum fibre stress recommended by the A. A. R. is 16,000 lb. per sq. in., and the tables show that the stress in 42.4 per cent of the total number of crank pin failures was above this limit. The stress in 27.2 per cent of the total number of main crank pins that failed was in the range between 15,000 and 16,000 lb. per sq. in.

### ANALYSIS OF CRANK PIN REMOVALS

*Average mileage before renewal of main crank pins*—The average mileage before renewal of main crank pins for causes other than failure is as follows:

| Class of Service | Average Mileage When Removed: Found Cracked On Inspection | Reached Wear Limit | Reached Mileage Limit |
|---|---|---|---|
| Freight | 104,500 | 144,300 | 164,000 |
| Passenger | 116,900 | 174,000 | 164,000 |

These results seem inconsistent in the case of freight locomotives with respect to the mileage attained on pins removed on account of reaching the wear limit and mileage limit. This inconsistency is due to the fact that service conditions undoubtedly influenced the results more in the case of freight locomotives. For example, on the 4-8-4 type locomotives 25 pins were shown to have been removed on account of reaching the wear limit with an average mileage of 127,900 miles, while 22 pins were shown to have been removed on account of reaching the mileage limit with an average mileage of 250,400 miles.

*Total number of crank pin renewals*—The total number of main crank pin renewals for causes other than failures on steam locomotives used in freight service is as follows:

| | No. of main crank pins renewed |
|---|---|
| Locomotives in freight service | 827 |
| Locomotives in passenger service | 744 |
| Total for 9 months' period | 1571 |

*Cause of crank pin renewals*—A summary of the causes of main crank pin renewals, for causes other than failures, on steam locomotives used in freight and passenger service is as follows:

| Class of Service | Found cracked on inspection | Per cent of total | Reached wear limit | Per cent of total | Reached mileage limit | Per cent of total | Total |
|---|---|---|---|---|---|---|---|
| Freight | 34 | 4.1 | 605 | 73.2 | 188 | 22.7 | 827 |
| Passenger | 137 | 18.4 | 347 | 46.7 | 260 | 34.9 | 744 |
| Total | 171 | 10.9 | 952 | 60.5 | 448 | 28.6 | 1571 |

*Types of locomotives on which pins were renewed on account of being cracked*—The analysis of main crank pins found cracked on inspection indicates that:

1—In freight service in proportion to the number of locomotives in service, more cracked pins occurred on the 4-8-4 type, although the greatest number of cracked pins were found on the 2-10-2 type.

2—In passenger service in proportion to the number of locomotives in service, more cracked pins occurred on the 4-6-4 type, although the greatest number of cracked pins were found on the 4-6-2 type.

*Stresses in crank pins removed for causes other than failure*—Fibre stresses for different crank pin materials and different types of locomotives used in freight and passenger service are given in two tables. The stresses were computed according to A. A. R. recommended practice. The maximum fibre stress recommended by the A. A. R. is 16,000 lb. per sq. in., and the above tables show that the stress in 43.1 per cent of the total number of main crank pins removed was above this limit. The stress in 19.7 per cent of the total number of main crank pins removed was in the range between 15,000 and 16,000 lb. per sq. in.

## Combined Analysis of Main Crank Pins Failing in Service or Removed for Other Causes

*Average mileage*—The average mileage of all pins removed is shown in a table which indicates that the general average for main crank pins in freight service is 148,600 miles, and in passenger service 161,100 miles. This is less than the average of failed crank pins due to the low average mileage of 104,500 in freight service and 116,900 in passenger service of main crank pins found cracked on inspection.

*Total number of main crank pin renewals*—The summary of main crank pin renewals is as follows:

| | No. of main pins renewed |
|---|---|
| Locomotives used in freight service | 896 |
| Locomotives used in passenger service | 799 |
| Total for 9 months' period | 1695 |

*Cause of main crank pin renewals*—A summary of the cause of renewal of all main crank pins in both freight and passenger service is as follows:

| Class of Service | Failed | Per cent of total | Found cracked on inspection | Per cent of total | Reached wear limit | Per cent of total | Reached mileage limit | Per cent of total | Total |
|---|---|---|---|---|---|---|---|---|---|
| Freight | 69 | 7.7 | 34 | 3.8 | 605 | 67.6 | 188 | 20.9 | 896 |
| Passenger | 55 | 6.9 | 137 | 17.2 | 347 | 43.4 | 260 | 32.5 | 799 |
| Total | 124 | 7.3 | 171 | 10.1 | 952 | 56.2 | 448 | 26.4 | 1695 |

*Crank pin materials*—The material and average mileage obtained at renewal for different materials where same could be definitely determined, classified by cause for renewals is shown in two tables. This is shown as a matter of information, as it is felt the data is insufficient to permit of drawing any conclusions.

*Types of locomotives on which main crank pins were renewed on account of having failed or being found cracked*—This information is shown classified by types of freight locomotives in two tables which indicate the number of locomotives of various types in service as of September 1, 1938, and that:

1. In freight service, in proportion to the number of locomotives in service, more renewals on account of failed or cracked pins occurred on the 4-8-4 type, although the greatest number of renewals occurred on the 2-8-2 type, closely followed by the 2-10-2 type.

2. In passenger service, in proportion to the number of locomotives in service, more renewals on account of failed or cracked pins occurred on the 4-6-4 type, although the greatest number of renewals occurred on the 4-6-2 type.

## General Conclusions

All indications point unmistakably to the fact that main crank pin failures are relatively more frequent, both in freight and passenger service, on modern engines capable of exerting high horsepower at high sustained speeds. This can readily be seen from a study of the data which indicates that for any driving wheel arrangement, as the number of trailing wheels increase, necessitated by the increased firebox and boiler capacity, the ratio of failed and cracked pins to the number of locomotives in service increases. Inasmuch as the data also points to the desirability of holding the fibre stress below 15,000 lb. per sq. in., the logical conclusion is that to reduce the possibility of main crank pin failures in locomotives designed for high horsepower outputs at sustained high speed, the total piston thrust should be divided over two driving units.

This, however, does not help the situation with respect to the many locomotives now in service, and which will be continued in service for some time to come. The situation is not critical as evidenced by the fact that on a yearly basis the number of main crank pins that fail in service is only two tenths of one per cent of the number of main crank pins in service, and the yearly cost of replacing main crank pins that fail in service or are found cracked on inspection amounts to approximately $30,000. However, the failure of a main crank pin on a locomotive at high speed will cause damage out of all proportion to the actual cost of replacing a crank pin, so that anything that can be done to prevent such failures is well worthwhile.

Proper machining is one remedy that is directly in the control of the individual road. Poor machining is indicated as the cause of 23.54 per cent of all main crank pin failures, so that considerable improvement can be attained through careful attention to proper machining. The importance of proper machining increases as the severity of service conditions increases so that on the modern types of power used under severe service conditions proper machining is paramount.

Next to proper machining probably the most feasible action that can be taken is to set up proper mileage limitations, depending on the type of locomotive and conditions of service. This cannot be set up on an average basis for all railroads, but must be done by each road for itself, adjusting the limitations set up in accordance with the ratio of the actual service conditions under which the locomotives are being used as compared to the general average. It is felt that the information contained in the analysis in this report will be helpful to roads desiring to set up such limitations.

As indicated before, it seems apparent that to materially increase the average life of main crank pins before failure it is necessary to considerably reduce the stress or find some means of improving the life expectancy under the present stresses. On existing engines, it is out of the question to reduce the stress, and on many new locomotives it will be found impossible due to limitations imposed in design on account of the axle diameter and stroke to secure a main crank pin with a fibre stress below 15,000 lb. per sq. in. Therefore, if means can be found to increase the life expectancy of the pin under the higher stresses it is important. From other investigations that have been conducted in somewhat analogous problems the committee is aware of two procedures that offer possibilities. These are: (a) Cold rolling the wheel fit of the crank pin; (b) Flame hardening the wheel fit of the crank pin.

These are definitely experimental, but the committee feels that with the issuance of this report all has been accomplished that can be accomplished by statistical studies, and these studies point to the need of some means of increasing the life expectancy of main crank pins. It is believed that this is a proper subject for A. A. R. experimental work, and it is recommended that con-

sideration be given to granting an allowance for such work along these lines next year.

### Tolerance for Cotter Keys

Conditions as regards variation in diameter of cotter keys as made by manufacturers, we find are substantially as reported by a member road. Further, we find that the various locomotive builders and railroads have no regular standards for the ordering of cotter keys but place orders as required with the different manufacturers of cotters, ordering same to the diameter of the drilled hole for the cotter.

We have canvassed the various cotter manufacturers, suggesting that an attempt be made to maintain a tolerance of nominal diameter —.005 inch, with the following results.

(1) To produce cotters to closer tolerances than present commercial standards does not appear attractive to the cotter manufacturers and they showed only meager evidence of a desire to cooperate in this direction.
(2) They pointed out that the cotters being made from wire are subject to two tolerances—one, the tolerance allowed on the wire size itself and the other, the tolerance allowed in the formation of the cotter.
(3) If a tolerance of nominal diameter —.005 inch is our aim, they would insist on a range from —.005 inch to —.010 inch under the nominal diameter.
(4) These would be special for railroad work and would not be carried in stock, necessitating the manufacture in relatively small quantities of cotters in the various sizes.
(5) Existing sizes conform to Government standards, Navy Department standards, Automobile manufacturers, and many others.
(6) When made to a tolerance of —.005 inch to —.010 inch under nominal size, the cost would be approximately 50 per cent more than the sizes now furnished in quantities of 100,000 and with smaller quantities the cost would be still further increased.

*Conclusions*—Inasmuch as cotters as now furnished are satisfactory for all other kinds of machinery and for many locations in locomotive construction, it would be the recommendation of this Committee that no change be made in existing standards, but where a tighter fitting cotter is desired, some form of expanding cotter be used.

The report included a statement covering tolerances secured from five different cotter manufacturers and reported by one railroad; also a summary of these various tolerances.

## Locomotive Boiler and Firebox Materials and Construction

While there are numerous types of boilers and fireboxes in use, some of which are of special construction, the great majority of locomotive boilers in use on the various American railroads are of the conventional type. Therefore the committee will undertake first to determine the best solution to some of the problems encountered in the design and maintenance of large locomotive boilers of the conventional fire tube wide firebox type.

During the past decade the principal trend has been to increase capacity, efficiency and reliability of locomotive boilers and at the same time reduce the cost of maintenance.

Capacity, other things being equal, is controlled or limited by boiler diameter. Therefore it appears this is a logical basis for comparison and proportion.

Boiler diameter controls capacity, primarily due to its control of the gas area of the flues which is confined within close limits if other desirable proportions are not encroached upon, such as: Distance between crown sheet and roof sheet which controls steam disengaging surface and steam space; Distance between combustion chamber and shell at bottom and sides; minimum allowable space between flues and firebox side and crown sheets to provide for suitable flange radius to provide flexibility and prevent excessive maintenance due to sheets cracking; width of water space at mud ring on sides and rate of increase in water space from mud ring to crown sheet radius; and, distance or space between flues to provide adequate circulation for maximum efficiency and prevent cracking of tube sheets between tubes.

Other proportions which control efficiency of operation and cost of repairs are ratio of length of combustion space to flue length and ratio of flue length to flue diameter.

The firebox capacity is controlled by clearance and weight limitations only. The size of grate area should be in proportion to the maximum output expected of the boiler and the quality of the coal to be burned.

The question of the percentage of air openings through the grates and the manner of admission of air, in addition to influencing capacity and economy, may be such as to have detrimental effects on firebox sheets and staybolts.

The committee will proceed first with the further study of general structural conditions in locomotive fireboxes. A questionnaire has been prepared and has been sent out to various railroads and locomotive builders in order to obtain the latest practice, data and formulae for the benefit of the Committee in its study.

The following is a resume of an investigation made by the Denver & Rio Grande Western as to locomotive boiler back end movement under hydrostatic pressures. The Report was dated April, 1940:

"An investigation was made to determine the movement of the component parts of the back end of a locomotive boiler (4-6-6-4 type) under hydrostatic pressures. The locomotive in question having inside dimensions of firebox as follows: Length 182 inches, width 104¼ inches. The length of firebox measured from back flue sheet to firebox door sheet is 28 feet 2 inches. Two syphons are installed in the firebox and one in the combustion chamber.

"Measurements of the movements were taken at 206 points on the back end of boiler, including inside of firebox and combustion chamber. Seven tests were made under the following conditions:

Boiler empty,
Boiler filled with water, no pressure.
Boiler under 100 lb. hydrostatic pressure.
Boiler under 200 lb. hydrostatic pressure.
Boiler under 255 lb. hydrostatic pressure.
Boiler under 319 lb. hydrostatic pressure.

The above tests had a water temperature of about 100 deg. F., and the seventh test was taken with 255 lb. hydrostatic pressure with a water temperature of 210 deg. F. The outside temperature under all tests was approximately 68 deg. F. A total of 1,418 readings were taken.

In general it was found that the top sags down and the sides spread out.

The maximum downward movement was 7/16 inch for the roof sheet and 31/64 inch (or nearly ½ inch) for the crown sheet. The maximum spread (both sides together) was 43/64 inch (or nearly 11/16 inch) for the roof sheet and 35/64 inch (or nearly 9/16 inch) for the crown sheet. Maximum downward movement is ¼ inch for the syphons. Maximum spread of the mud ring was 3/32 inch. Maximum spread between the syphons was 11/16 inch. Maximum longitudinal movement was 19/64 inch (or nearly 5/16 inch) at 210 deg. temperature.

It developed that the downward movement in the vertical direction is smaller at 210 deg. F. temperature than at 100 deg. F., and the lateral spread is greater at 210 deg. F. than at 100 deg. F. temperature.

These movements indicate that the back end of a boiler is continually moving up and down in the vertical direction and in and out in the lateral direction whenever there are changes in pressures and temperatures. Therefore, the back end of a boiler must be of substantial construction in order to keep movement down to a practicable minimum. Roof sheet thickness should be developed to meet deflection requirements as well as strength requirements.

### Other Items

Progress was reported by sub-committees on locomotive guiding, spring suspension and rail stresses; stresses in rods and motion work, and standardization of wrought steel wheels for Diesel locomotives and steam locomotive tenders.

The report was signed by H. H. Lanning (chairman), mechanical engineer, A. T. & S. F.; H. P. Allstrand (vice-chairman), assistant to chief executive officer, C. & N. W.; E. L. Bachman, general superintendent motive power, Pennsylvania; F. E. Russell, mechanical engineer, Southern Pacific; W. F. Connal, chief mechanical engineer, C. N. R.; J. E. Ennis, engineering assistant, N. Y. C.; J. B. Blackburn, mechanical engineer, C. & O.; L. H. Kueck, chief mechanical engineer, Mo. Pac.; W. H.

(*Continued on page 46*)

**Where Rubber and Allied Products Are Tested at the Pennsylvania's Large, Well - Equipped Testing Laboratory at Altoona, Pa.**

# Materials Get Attention at Atlantic City Meeting

## Many products for railroad use are among those given consideration at forty-third annual convention of the American Society for Testing Materials

MANY materials problems of direct or indirect interest to the railroads were considered and acted upon at the forty-third annual convention of the American Society for Testing Materials, which was held at Atlantic City, N. J., on June 24-28. Altogether, more than 100 technical papers and reports were presented during the meeting, which involved 22 separate sessions, each devoted to reports and papers on allied or related subjects. The registration totaled 1,441 members and guests, the highest figure ever attained at the Atlantic City meetings and the second highest in the history of the society.

As in past years, much of the work of the convention was given over to the consideration of specifications for various materials and tests. As a result of this phase of the activities about forty existing tentative specifications were approved for reference to society letter ballot for adoption as standard, while seventy-seven tentative specifications were voted on affirmatively. This is the largest number of tentative specifications ever to be approved at a single meeting, a significant fact in that such specifications represent new work or extension of the society's program. In addition, many recommendations were approved covering revisions in standards and tentative standards, while a number of tentative revisions of standards were adopted, and other standards were withdrawn. Included in the program were a number of symposiums, one of which dealt with problems arising through the classification of natural waters intended for industrial use.

The meeting was presided over by H. H. Morgan, president of the society and manager of the Rail and Fastenings department of the Robert W. Hunt Company. In the election of officers, Dr. W. M. Barr, chief chemical and metallurgical engineer, Union Pacific, was advanced from vice-president to president, and Herbert J. Ball, head, Department of Textile Engineering, Lowell Textile Institute, was elected vice-president. A brief biographical sketch and a photograph of Dr. Barr were published in the *Railway Age* of June 27.

### President's Address

In his address at the opening session of the meeting, President Morgan devoted his remarks to a discussion of standard specifications for materials and their commercial importance. After defining specifications and describing their functions, Mr. Morgan listed the specific advantages that may be expected to accrue through the use of good specifications. These, he said, are as follows: (1) They enable the buyer to get what he wants; (2) the material is of uniform quality; (3) the buyer receives goods more quickly and with less trouble; (4) he has access to wider markets; (5) costs are lower; (6) a suitable acceptance base is established; (7) material becomes standardized, and (8) research is promoted.

Mr. Morgan stated that the practical importance of specifications hinges directly on their ability to assure the buyer that he is receiving exactly the grade he orders. Buyers that cannot maintain the expert personnel or research facilities necessary to write adequate specifications can increase their efficiency, he said, by utilizing standard specifications, such as those of the A. S. T. M., as well as by using standard materials and the facilities afforded by research institutions and commercial inspection and testing laboratories.

It is of interest to note that in the report of the Executive committee of the society, which was presented by C. L. Warwick, secretary-treasurer, it was reported that, as of June 1, the number of sustaining members was 88, an increase of 67 as compared with last year, and this number has been augmented still further by new additions since that date. Among the companies that have thus recently pledged themselves to lend increased financial assistance to the society is the Pennsylvania railroad and a number of important railway supply companies. It was explained that of the 67 additions to the list of sustaining members, 58 were acquired by the transfer of existing company memberships and 9 were acquired by companies which had not previously held company memberships, although most of them had been affiliated with the society's activities through one or more individual memberships.

A feature of the program that drew particular attention in view of the present state of international affairs was an address, entitled Materials Standards in National Preparedness, which was presented at the opening session by Lieutenant Colonel William C. Young, who is attached to the Planning branch in the office of the Assistant Secretary of War. Col. Young outlined the needs of the preparedness program, and described the measures that are being taken to assure that the fulfilment of this plan will be realized in a minimum of time. He also devoted considerable attention to the problem of standards for materials, and said that, in the event the nation is faced with a major emergency, it may be expected that the activities of such leading organizations as the A. S. T. M. will be of great assistance in bringing it to a successful conclusion.

## Lecture on Cement

A material that is used widely by the railroads, namely cement, was the subject this year of the Edgar Marburg lecture, which was presented by P. H. Bates, chief, Clay and Silicate Products division, National Bureau of Standards. In a comprehensive paper on the subject, Mr. Bates discussed in detail the history and chemical composition of portland cement, the phenomenon of hydration and the manner in which it is affected by the composition of the cement. He asserted that there is an outstanding lack of needed physical tests for cement. The Committee on Cement, of which he is chairman, is offering this year specifications for five types of cement in place of the two now in existence, and Mr. Bates dealt with the advantages inherent in the availability of these five types. His discussion also included reference to such subjects as the control of fineness; the functions of the autoclave test; the resistance of cements to aggressive solutions of salts; the use of admixtures in cement, which he advocated; the development of suitable tests; and the effects of plant processes on the physical properties of cement.

Six sessions of the convention were devoted to a consideration of committee reports and papers dealing with the general subject of metals. The Committee on Steel reported that prominent among its standardization activities last year was intensive work involving forgings, pipe and tubing, and materials for high-temperature service, including pipe, castings and forgings. Many of the recommendations made by this committee involved materials that are used widely by the railroads. A partial list of the specifications included in the committees recommendations follows:

**New Tentative Standards**

Carbon-Steel Forgings for Locomotives and Cars
Alloy-Steel Forgings for Locomotives and Cars

**Revisions of Tentative Standards**

Heat-Treated Carbon and Alloy-Steel Track Bolts and Nuts (A 183-39 T)
Seamless Steel Boiler Tubes for High-Pressure Service (A 192-38 T)*
Electric-Resistance-Welded Steel Boiler and Superheater Tubes for High-Pressure Service (A 226-39 T)*
Seamless Carbon-Molybdenum Alloy-Steel Boiler and Superheater Tubes (A 209-38 T)*
Lap-Welded and Seamless Steel and Lap-Welded Iron Boiler Tubes (A 83-38 T)*
Medium-Carbon Seamless Steel Boiler and Superheater Tubes (A 210-38 T)*
Seamless Alloy-Steel Boiler and Superheater Tubes (A 213-39 T)*
Carbon-Steel Castings Suitable for Fusion Welding for Service at Temperatures up to 850 F. (A 216-39 T)
Alloy-Steel Castings Suitable for Fusion Welding for Service at Temperatures from 750 to 1100 F. (A 217-39 T)

**Revisions of Standards, Immediate Adoption**

Boiler Rivet Steel and Rivets (A 31-39)
Welded and Seamless Steel Pipe (A 53-36; ASA No. B36.1-1936)

**Tentative Revision of Standard**

Structural Steel for Locomotives and Cars (A 113-39)

**Adoption of Tentative Standard as Standard**

Spiral-Welded Steel or Iron Pipe (A 211-38 T)

**Withdrawal of Standards and Tentative Standards**

Carbon-Steel and Alloy-Steel Forgings (A 18-30)
Normalized Quenched-and-Tempered Alloy-Steel Forgings (A 63-39)
Normalized and Tempered Alloy-Steel Forgings for Locomotives (A 133-33 T)
Carbon-Steel Forgings (A 18-39 T)

An important addition in the specifications for carbon forgings for industrial use was a grade for use in bridge work with a tensile strength of 66,000 lb. per. sq. in. and a yield point of 33,000 lb. This item was not included in the report of the Committee on Steel but was approved at the meeting.

Reporting on corrosion-resisting iron-base metals the Committee on Iron-Chromium, Iron-Chromium-Nickel, and Related Alloys stated that the compilations of data on chemical analysis, mechanical properties and heat treatment of chromium and chromium-nickel alloys is expected to be completed during the year. Among other matters, the report also discussed the interest of the committee in the welding of stainless steels and particularly in the formulation of a code for welded structures other than pressure vessels.

## Wrought Iron and Steel

The Committee on Standardization of Dimensions and Materials of Wrought-Iron and Wrought-Steel Pipe and Tubing reported that it had approved a number of re-

* These specifications were also approved for reference to society letter ballot for adoption as standard.

visions in American Standard specifications for various pipe materials, which are a part of the American Standard for wrought iron and wrought steel pipe. The specifications involved in these revisions are those for welded wrought-iron pipe, electric-fusion-welded steel pipe and lap-welded and seamless steel pipe for high-temperature service. The committee reported that the revisions had been approved by the A. S. A.

Among other things, the Committee on Cast Iron reported that Subcommittee III on Cylinders, plans to revise the standard specifications for cast iron locomotive cylinders in order to bring them up to date. This report and those of a number of other committees were presented during a session devoted to corrosion and iron. In a brief interim report on its atmospheric corrosion test on specimens of fine wire, the Committee on Corrosion of Iron and Steel stated that inspections made since the last published report show further rusting of the lighter zinc-coated wires at Pittsburgh, Pa., Sandy Hook, N. J., and Bridgeport, Conn. It was observed further that no rusting has taken place in the groups carrying coatings heavier than 1.0 oz. per sq. ft. at Pittsburgh, or heavier than 0.45 oz. per sq. ft. at Sandy Hook. At State College, Pa., and at the remaining seven sites, no rust has appeared on any of the coated wires.

One of the papers presented during the session on corrosion and iron gave the results of six series of atmospheric corrosion tests that were conducted with sheet specimens of low alloy steels containing nickel and copper. One of the series consists of large specimens so arranged and exposed as to simulate some of the conditions to which roof sheets are exposed in service, one of this series of tests being located on the roof of a passenger train shed at Jersey City, N. J. Another of the series embraced the use of nickel-copper steel in the repair of a number of railroad coal cars. A general conclusion that was drawn from these tests is that the beneficial effects of nickel upon the weathering resistance of steel increase with increasing nickel content and are enhanced by the addition of an optimum amount of copper.

## Axles Tested

An entire session of the meeting was devoted to papers and reports on fatigue and corrosion-fatigue, and among the features of this session was a paper reporting the results of a fatigue investigation of axles coated with metal, and flame hardened. The axles used in this investigation were 2 in. in diameter and were sprayed with carbon wire stock. They were tested as cantilever rotating beams. The test results with plain specimens indicated little difference in the endurance limit of coated axles over that for uncoated axles, but press-fitted wheel and axle assemblies showed a great increase in the endurance limit of the coated and flame-hardened axles as compared with the untreated specimens.

The report of the Committee on Bituminous Waterproofing and Roofing Materials contained a number of recommendations, including one to the effect that the tentative specifications for woven cotton fabrics saturated with bituminous substances for use in waterproofing be revised with respect to the ash requirement and continued as tentative. This committee also recommended the adoption as standard of the two tentative methods of test for sieve analysis of mineral surfacing materials for asphalt roofing and shingles. The recommendations of this committee were accepted.

In its report, the Committee on Soils for Engineering Purposes offered for adoption four new tentative methods for testing soil-cement mixtures. These included a test for moisture-density relations of soil-cement mixtures, a wetting-and-drying test of compacted soil-cement mixtures, a freezing-and-thawing test of compacted soil-cement mixtures, and a test for water absorption and resistance to plastic flow of mixtures of soil and emulsified asphalt. The first three of these tentative items were approved but considerable opposition developed regarding the latter test and this subject was referred to the Standards committee for study.

## Cement and Concrete

Two of the technical sessions were devoted to a consideration of reports and papers on cement, concrete and allied materials. The Committee on Cement reported that its major accomplishment during the year comprised the development, as mentioned by Mr. Bates in his address, of new tentative specifications embracing five types of portland cement. These specifications, to become effective on September 2, 1940, are ultimately to replace the present standard specifications for portland cement and for high-early-strength cement. The committee's recommendation that the new specifications be published as tentative was approved. A new test for the soundness of portland cement by the autoclave expansion method was also offered as tentative and was approved.

The Committee on Concrete and Concrete Aggregates included among its recommendations a new tentative laboratory method for determining the efficiency of materials for curing concrete, and also a new tentative method for determining the volume change of cement mortar and concrete. Both of these recommendations were approved. In addition, the Committee on Concrete Pipe presented revisions (which were approved) in the four standards for which this committee is responsible, namely, those for concrete sewer pipe, irrigation pipe, reinforced-concrete sewer pipe, and reinforced-concrete culvert pipe. The Committee on Mortars for Unit Masonry announced the appointment of three new subcommittees on admixtures for mortar, on mortar for glass blocks, and on efflorescence.

Papers that were presented during the sessions on cement and concrete dealt with such subjects as the theory of concrete creep, autogenous volume changes of concrete (those due to other than external causes), properties of mortar in masonry, and the absorption and freezing-and-thawing tests of coarse aggregate. The latter comprised a discussion of the effects of various preliminary treatments on the total absorption and on the ultimate deterioration of the material in freezing and thawing.

## Masonry and Related Materials

In its report, presented during a session on masonry and related materials, the Committee on Manufactured Masonry Units recommended the adoption as standard of the existing tentative specifications for solid load-bearing concrete masonry units, and presented a revision in the tentative specification for building brick made from clay or shale. These recommendations were approved. Presented during the same session was the report of the Committee on Clay Pipe, which recommended the adoption as standard of the tentative revision published since 1938, providing for increased crushing strength requirements for clay sewer pipe 18 in. to 36 in. internal diameter. This recommendation was also approved.

During a session on water, the Committee on Water for Industrial Use presented its report in which it submitted a standardized method for reporting the analysis of water intended for industrial use. Revisions were

also recommended in five tentative standards covering methods of analyzing industrial waters. All of the committee's recommendations were approved.

The session on water included a symposium on problems in the classification of natural waters for industrial use, the expressed purpose of which was to develop uniformity in reporting water analysis and to secure data from which specifications may be developed. This phase of the program involved the presentation of four papers on reporting the results of water analysis, measuring the scale-forming and corrosive tendencies of water by short-time tests, measuring corrosiveness, and the relationship of the corrosivity of water to its chemical analysis.

In addition to those mentioned in the foregoing, reports presented at the meeting that were of direct or indirect interest to railroad men include those of the committees on Coal and Coke; Timber; and Paint, Varnish, Lacquer and Related Products. Similarly, among the papers was one dealing with the methods of inspecting wood poles by X-ray, in which it was stated that, with proper technique, various stages and degrees of rot may be discerned under a wide variety of conditions.

# Protection Men Hold Session in Montreal

A TOTAL of 80 representatives of North American railroad police departments and guests convened at the Windsor hotel, Montreal, Que., on June 26-28 for the 20th annual meeting of the Protective section, Association of American Railroads. Attendance was only about half of the normal figure, due principally to war conditions which have put especially heavy demands on protection officers. In addition to routine committee reports and remarks by railroad officers, the meeting was addressed by representatives of the city of Montreal and federal and Dominion agencies engaged in the suppression of crime.

That claims paid out by roads in the United States and Canada on account of theft and concealed and unlocated loss in 1939 were a reduction of 95 per cent as compared with payments in 1920 was pointed out by G. A. Shea, director of investigation, Canadian National, and Chairman of the Section, in his opening remarks. Specifically, such claims totaled $44,000,000 in 1920 and $2,500,000 in 1939. All claims paid by railroads, including loss and damage, etc., were reduced 88 per cent during the same period. Mr. Shea also made the interesting statement that coal and coke constitutes the class of freight on which the highest claims for theft are paid. Drygoods and textiles are second in order, while tobacco products take third place.

Colonel R. S. Henry, assistant to the president in charge of public relations, A. A. R., emphasized the role of the railroads in providing the mass transportation necessary to bind together the North American continent. After a review of the intimate relationships between carriers in the United States and Canada, the speaker reminded his hearers that the former are now being summoned to a great program of preparedness while the latter have acquitted themselves in the service of a nation at war for a number of months. "And," said he, "it is funny how quickly people turn to the railroads in time of emergency."

As for the popular belief that the railroads "broke down" in 1917 so that government control was made necessary, the Colonel countered that "railroads are transportation machines, they are not in the storage business." The facts were that government agencies competed for priority and battled with the familiar red priority cards to see which should "have priority over all priorities." He recalled that 5,000 cars of piling arrived for the Hog Island shipyard at Philadelphia, Pa., long before they were needed and any arrangements had been made for their unloading. Carloads of anchors arrived before any keels had been laid.

Col. Henry declared that simple but complete plans for war measures have already been worked out with the military authorities and discussed with private and governmental shippers. The essence of the plan is that nothing will be loaded into cars unless arrangements are made for unloading at destination.

To illustrate the effect of governmental influences in *creating* a transportation problem, the speaker took the case of the Florida East Coast which opened up a virtual wilderness through private capital some 60 years ago. He told how the government built a totally free canal along one side of the F. E. C., a fine highway along the other and a well-equipped air-way over the top. "As yet it has not occurred to anyone to build a subway under the railroad by public funds, but give 'em time," he interjected, adding, "What other business would be so completely surrounded by the competition of its own government?"

J. C. Caviston, secretary of the Section and chairman, committee of direction, presented the significant items in railroad protection activities during 1939. In that year police officers of an average of 89 roads reporting monthly made a total of 115,905 arrests—7,977 for felonies and 107,928 for misdemeanors, a *decrease* of 1,368—970 for felonies and 398 for misdemeanors—as compared with 1938. Convictions were obtained in 99.2 per cent of the total number of cases tried. [Chairman Shea pointed out at another point that most non-railroad police forces boasted when 90 per cent convictions were achieved.—Ed.].

Mr. Caviston called particular attention to the fact that 6,291 of the total number of persons arrested by railroad police in 1939 were wanted for more serious crimes and were turned over to civil authorities therefor.

### Theft Losses Lowest on Record

The secretary reported that claim payments accountable to theft totaled $407,742 in 1939, the lowest figure on record since such data have been compiled. The ratio of theft payments to total freight claim payments made by the railroads was 2.2 per cent, as compared with 10.3 per cent, in 1921.

In discussing the questions which have come up for consideration during the year, Mr. Caviston reported among other things, that the Purchases & Stores division, A. A. R., has recommended that some 198 materials be identified by a special mark at time of purchase of agents to reduce theft; that 34,650 placards warning of penalties for violation of the Carlin Act covering theft of interstate shipments have been posted by railroads, that the Committee of Direction recommends that "Slater's Telegraphic Code" be used by the heads of railroad police when transmitting confidential messages; and that a committee from the Section has conferred with the Federal Bureau of Investigation on the subject of sabotage, resulting in the publication by the Section of Circular P-646 outlining the understanding reached.

L. A. Thomas, assistant to vice-president (investigation and police), Southern, discussed ways and means of reducing cigarette thefts. He has found from experience that the best way to keep cigarettes from thieves is "to

keep them moving," and not hold such cars for tonnage. He also recommended that cars containing cigarettes be moved on card billings so that the contents will not be disclosed, and emphasized that car seal protection is vital. The Southern has reduced losses substantially by ordering immediate unloading of cigarette shipments at stations with warehousing in special locked compartments under constant surveillance.

Mr. Thomas also discussed a new type of thief which goes the rope ladder expert one better. This worker cuts a hole in the roof of cars while in transit; detection is difficult because car doors remain undisturbed. The speaker recommended routine inspection of roofs as well as doors.

The report of the committee on trespassing, rendered by Chairman G. W. Buzby, superintendent of police, Pennsylvania, recalled that the committee, in order properly to study the trespass evil, communicated with a number of police or special service departments heads, to determine whether or not, in their opinion, the individual states had adequate laws to cover illegal train riding and trespassing on railroad property. The replies received at that time indicated that 28 states and the District of Columbia had laws which apparently covered illegal train riding from a railroad standpoint, while 17 states had laws which did not seem satisfactorily to cover this subject. The state laws covering trespassing on railroad property indicated 11 states and the District of Columbia had adequate laws while 34 states appeared to have inadequate laws.

"It was, and still is, the opinion of the Trespass committee that the Connecticut State Law, quoted below, is the most comprehensive brought to their attention:

SECTIONS 6159 AND 6307—CONNECTICUT (1918) STATE LAW TRESPASS ON RAILROAD

"Any person who shall without right, be upon or attach himself to any engine or car upon the track of any railroad, or occupy or be upon any part of the platform or grounds of any station or yard of any railroad, or be upon the track or right-of-way of any railroad, or ride, drive or lead any beast on such track, shall be fined not more than fifty dollars or imprisoned not more than thirty days or both."

The committee has continued the monthly compilation of figures showing the number of trespassers prevented from getting on trains, removed from trains or ejected from railroad property but not arrested. An analysis of the cumulative figures indicates that during the year 1939, an average of 79 railroads reported a total of 3,626,256 trespassers were removed, but not arrested; during 1938, an average of 80 railroads reported 3,880,872 cases; during 1937 an average of 74 railroads reported 3,832,941 cases. Thus the 1939 figures show a decrease of 6.5 per cent compared with 1938; an increase of .7 per cent compared with 1937 and a decrease of 5.4 per cent compared with 1936.

The program of the meeting included as speakers, in addition to those mentioned above, J. H. Butler, traffic executive, Railway Express Agency; J. N. Godman, superintendent of police, Reading-Central of New Jersey; H. J. Humphrey, vice-president and general manager, Eastern lines, Canadian Pacific; F. G. Love, superintendent property protection, New York Central; A. L. Green, special representative, Freight Claim division, A. A. R.; W. G. Fetzner, chief special agent, Chicago, Burlington & Quincy; F. F. Phillips, superintendent special service, Coast lines, Atchison, Topeka & Santa Fe; and E. J. Brennan, chief special agent, Pullman Company.

Officers elected for the coming year were: Chairman, J. N. Godman, superintendent of police, Reading-Jersey Central; vice-chairman, L. A. Thomas, assistant to vice-president (investigation and police department), Southern Ry.

# Communication . . .

## Col. Wilgus Again Urges Government Ownership

ASCUTNEY, VT.

TO THE EDITOR:

In this grave hour it behooves all of us of the railroad profession frankly to take note of our weaknesses that they may be cured in time. Railroads are indeed our primary organ of national defense. Without adequate means of movement, men and munitions are as naught. The War Department in this is asleep, as evidenced by the recent speech of the Assistant Secretary of War who has been led to believe that our railroads are "financially sound and physically strong."

Complacency in conformity with a policy of adherence to the *status quo* can be as ruinous to us as it has been to Great Britain and France. So I beg of you that the hospitality of your columns be extended to the accompanying address, presented at a meeting of the American Institute of Electrical Engineers at Swampscott, Mass., on June 27.

WILLIAM J. WILGUS.

EDITOR'S NOTE: Our comment on Col. Wilgus' views appears on the editorial pages herein. We are glad to present in the following his address, virtually in full:

"The facts that I shall lay before you will, in my judgment, lead you logically though reluctantly to the conclusion that the private ownership of our financially-stricken, disunited railroads is doomed. With that admitted you will, it seems to me, reach the further conclusion that upon their amalgamation into a harmonious whole under federal auspices, their pressing needs for rehabilitation and improvement may be met and some form of co-ordination with their rivals in transportation brought about, all in the public interest.

"We shrink from this further governmental invasion into the field of private enterprise, but in these days of peril we may no longer temporize with a situation fraught with danger. If private enterprise serving an urgent public need cannot finance its necessities, federal intervention is the only recourse. Society, after all, depends for its very existence on travel and trade, and equally so on the movement of men and munitions for national defense. To the extent that the means of serving these purposes are faulty, to just that extent will our society suffer; aye, perhaps go under as have other civilizations in the distant past.

"When we look backward over our national life-span of 150 years, we see how man and animal power and the sail gave way to the steamboat, followed in succession by the steam locomotive, the electric motor and pipeline in certain instances, and finally the internal combustion engine. Out of this Topsy-like growth has emerged a system of transportation in which chaos reigns, each of its five types at war with the others and within itself.

"Of these types—railroads, highways, waterways, pipelines and airways—the first named, though sadly stricken in recent years through the diversion of competitive traffic to its rivals, still remains the backbone of our transportation machine and promises so to remain indefinitely so far as we can read the future. It is dependable in all kinds of weather—winter and summer, fall and spring. It reaches every nook and cranny in the land by continuous routes carrying freight in interchangeable equipment under uniform rules and regulations and joint through rates. It is adapted to speedy mass movements of persons and of property of widely differing weights and bulk. It is in brief a closely interwoven network of interdependent links united physically though disunited in a managerial and financial sense. None of its rivals can meet these conditions in full.

In a national emergency it is vital for the swift dispatch of troops from all over the land to cantonments and thence to their objectives; and of the innumerable products of soil and forest and mine to mill and factory and thence to storehouses, shipyards, ports and scenes of conflict. Over its rails must move big-caliber naval guns on wheels for coastal defense and for distant bombardments of enemy centers; also guns and armor and machinery for battleships as well as modern engines of warfare such as mammoth tanks, all too heavy and too bulky for highway and air transport and too urgently required on the

minute for the winter interruptions, uncertainties and long delays of internal movements by water.

**Evils Resulting from the Long-Continuing Depression**

"It is natural at this point to ask to what extent the railroads as a whole have suffered from the effects of the past 10-year depression. For an answer we have but to turn to the authoritative *Railway Age* of January 7, 1939, to learn that they have been deplorable. Not only have items of equipment fallen off in great number, but what remain are to a large extent outmoded and over-age. Forty-five per cent of the cars are reported to be more than 20 years old and 70 per cent of the locomotives over 19 years old, both spelling inefficiency and costly up-keep. They call for replacement on a gigantic scale in which shall be embodied advancements in efficiency, adaptation, comfort and attractiveness in the public eye.

"Terminal and port facilities in many cases call for modernizing; bridges and masonry for repair and strengthening; embankments and cuts for widening, riprap protection and drainage; level crossings for separations of grade; gradients and curves for reduction and straightening respectively; main lines call for multiple tracking; sidings for lengthening; water and fuel stations for betterment and expansion; shop tools and work equipment for replacement and betterment; centers of congestion call for by-passes; station buildings and right of way for freshening in the interest of good appearance; rail, ties and ballast call for renewal and betterment; signals and interlocking for extended use in the interest of safety and expedition; and other parts of the railroad machine as a whole, after so many years of neglect, likewise call for rehabilitation and improvement.

"It has been asserted by representatives of the A. A. R. that the picture is not as black as thus painted because the falling off in traffic during the past ten years has resulted in a let-up on wear and tear. This claim fails to give weight to the well known deteriorative effect of rot and rust and frost and storm, and to obsolescence and inadequacy, all of which in the aggregate cause depreciation regardless of use. Generally it has been considered that two-thirds of the expense of maintenance is chargeable to the passage of time. If we compare the average annual outlays for maintenance prior and subsequent to 1929 we find that their decrease since that date, fairly assignable to the passage of time on a half-and-half instead of a two-thirds basis, amounts to more than a half a billion dollars per annum. A similar comparison of the sums annually devoted to improvements before and after 1929 shows a shortage of about the same amount.

"A combination of the two approximates a billion dollars a year; a figure that coincides with that given in the issue of the *Railway Age* to which I have referred. That authority, quoting the words of the President's 'Committee of Six' and the vice-president and general counsel of the Association of American Railroads, considers that that annual sum should be expended for several years in order that the railroads as a whole shall regain lost ground and meet the demands of the hour. For a period of five years, therefore, the railroads, by and large, should have poured into them some five billion dollars, a figure that is but slightly in excess of that given for improvements only by our fellow engineer, Ralph Budd, president of the Chicago, Burlington & Quincy and now a member of the recently appointed Committee on National Defense.

"I may perhaps be pardoned for adding a page from my own past experience in the rehabilitation and improvement of one of the principal systems of the country following the depression of the 1890's. Its main route traversed by crack trains gave no outward indication of grave defects that lurked beneath, nor of bad conditions on the side lines and branches and in terminals not visible to the principal officers and influential travelers who seldom if ever viewed them. Safety everywhere on the system was at stake; and the reasonable convenience and comfort of passengers whether they were carried in luxurious state on the main stem or in a humbler way in vastly greater numbers on the lesser routes. From my observations of today I feel that the same remarks are in order if our railroads in some degree are to win back their old prestige.

"In a word, what is needed is an added investment in our railroads approximating five billion dollars in order that they may meet their social obligations with satisfaction to their patrons of high and low degree and, above all else, faultlessly back the Army and Navy in our hour of trial.

"How is this enormous sum to be raised? Certainly not from private sources unbacked by the government. The railroads' share of the total national income since 1919 has been steadily downward in good times and bad. Their average revenue per ton-mile since 1916, in an effort to make up for their striking losses in passenger revenue, has been maintained at a far higher level than the price level of the commodities they carry, thereby driving their shippers into the arms of their rivals. Their net operating income since 1916 has dropped something like a half, though some eight billion dollars have been poured into the enterprise. Two-thirds of their mileage is in the courts or on the ragged edge of insolvency. Their bonds in large part have been removed by the State of New York from its list of permissible savings bank and trust fund investments.

"Their stocks—that is their venture capital—are with rare exceptions unsaleable, although essential in private enterprise as a cushion for the protection of the funded debt. Their consolidation into a limited number of systems, with the accompanying scaling down of their securities to modest limits, has no promise of accomplishment in the reasonably near future. Briefly, the credit of the railroads as a whole has vanished. Their only recourse is government aid which at present is extended to them on a comparatively small scale, and in reality a back-door entrance to complete control without responsibility for the outcome.

"It will be said, no doubt, that the present upsurge of war traffic points to the coming of better days. But surely this cannot be viewed as a permanent, or for that matter a temporary, solution. The aftermath of war, as proven by history, will be quite the other way. Even as it is, the railroads in large part are still in the depths of despond. During the first quarter of this year more than one-half of the R. F. C. selected Class I railroads in the New England and Eastern Regions failed to earn their fixed charges, one-third in the Southern Division, 90 per cent in the Northwestern Region, three-quarters in the Central Western region, and nearly a half in the Southwestern Region.

"Only in the Pocahontas Region were fixed charges earned in full by all three roads. In the aggregate, 44 out of the 81 railroads fell by the wayside and of these 11 did not even earn their operating expenses and taxes! On top of this it is to be expected that taxes and costs of materials as a result of our measures for defense will go up, while freight rates will remain stationary or continue downward. In light of the past and present, and of what is ahead of us in a world of turmoil, we must not rest our fate as a nation on wishful thinking. The money required to put the railroads on their feet is as much needed right now as are the billions of new money at present being appropriated for our other means of national defense. We cannot for our nation's safety afford to rest its fate on a hoped-for railroad come-back not now in sight.

"By many this additional call for funds on such a scale will have an ominious sound. But rightly handled it is not to be feared. Taken over by a Federal Railway Authority in return for its low-interest-rate securities, the railroads as a whole should not cost more than fifty per cent in excess of their market value of some ten billion dollars as of a year ago, or say fifteen billions in all. The actual annual net operating income during the past ten years has averaged enough to support an investment of twenty billion dollars at the government's present low rate of interest. The difference, five billion dollars, raised through the sale of the Authority's securities, would pay for the needed rehabilitation and improvements. In addition the money thus released from the country's frozen resources would relieve our W. P. A. rolls and inject new life into the arteries and veins of many of our moribund industries.

"Time now being of the essence, the railroads under this plan would be taken over at the stroke of the bell, as they were at the beginning of 1918, on the basis of a fair annual rental as was done at that time, pending the determination of their fair value in courts to be set up for the purpose. With this would go a form of co-operative management, free from politics, in which the five interests involved—executives, labor, shippers, investors and the public-at-large—would take their part. In this connection I venture to direct your attention for details to an article from my pen in the October, 1939, issue of 'Civil Engineering.'

"There are several reasons why no time should be lost in bringing this about. Our equipment plants and steel mills will

have no room for railroad needs if they are to become loaded to the limit of their capacity with orders for munitions at home and abroad. Lines in whole or part incapable of earning a commercial return, like the Ontario & Western, Rutland, Old Colony, Long Island, Norfolk & Southern, Chicago & North Western, Omaha, Alton and Minneapolis & St. Louis, may be abandoned in whole or part if not rescued for national defense. After all, a main line or branch essential in an emergency for the transport of troops and supplies, or gun-mounts or tanks, should not be expected necessarily to earn its way, any more than is the battleship or army expected to yield a money return. Again, a speedy survey of the railroad situation in qualified hands should not only determine what rehabilitation and improvements should be undertaken in their proper order, and the estimated cost of so doing, and what lines should be retained from the angle of defense regardless of their earning power, but also what lines with propriety really should be abandoned so as to obviate the expenditure upon them of money, as for instance on the elimination of grade crossings, which would be thrown away.

**Co-ordination A Necessity**

"With the making of such a railroad survey should go similar action in the other types of transportation, not with the idea that they should be taken over by the government, but to determine their scope and nature, and the extent to which public regulation should be instituted in the interest of all; also to inaugurate an organization whereby their activities and those of the nation's railroad system may be co-ordinated somewhat as I have indicated in the 'Civil Engineering' article to which I have previously referred.

"Transportation in the United States is a social problem of the first magnitude that must be wisely solved, and that, too, without further loss of time if the country is to be put in readiness for defense. Others may have a different solution than mine. If so, I pray that they may speak up convincingly. Whatever it may be I venture the belief that it should be founded on the principle that 'united we stand divided we fall.' A disunited system of railways will no more succeed in its aim to protect the interests of the nation, than did our confederation of states politically before we became the United States. The Association of American Railroads, as now constituted, is without power to enforce its decrees. Its members naturally have their individual interests first to serve and not those of the system as a whole. No temporizing will cure this defect. Co-operative management under federal auspices will accomplish that end, and in co-ordination with the other means of transportation cement all of them together for the nation's good.

"If the solution I have proposed is deemed to be faulty, what is the alternative that will loosen the country's funds so that they will flow instanter into the field of transportation?

**Misconception of War Needs**

"I can imagine that my esteemed adversary in this discussion, Colonel Henry,* will dwell on the quickened movement of trains and cars in recent years. In that I will fully agree with him and tender to him my congratulations. But should he claim that this will make up for the railroads' lessened volume of equipment in war time I must disagree. Needs for cars and locomotives in areas of conflict—theatres of operation as they are called—are likely to be very heavy, for which the home railways will have to yield of their stock on hand. In France during the World War we had on demand upwards of 5000 locomotives and 100,000 cars. Allies, too, on this hemisphere or elsewhere will look to us for aid in this particular.

"The exigencies of war cause upsets in regular schedules with resultant lessening of the efficiency usual in peace time. Solid trains of empty cars, without awaiting loads, often must be sent long distances for urgently needed materials. Interruptions or curtailments in our inter-coastal or other coast-wise water traffic would throw a greatly increased burden on our rails. Loaded cars will be held immobile at ports when shipping may be held up by ice or unanticipated war conditions. Losses in the field will reduce the available stock of cars and locomotives. Trained personnel must be drawn upon for the operation of military railroads, leaving untrained men to take their places with an unavoidable loss of efficiency in train and car movements. Friction resulting from enforced diversions of traffic from one road to another, such as occurred in the World War, will have baneful consequences. I speak of these from personal knowledge. No greater mistake can be made than to close the eye to these conditions—to deny experience—and invite a breakdown of our transportation machine at some critical moment in our affairs.

"After all, it is to our means of intercourse that we must look for the preservation of our civilization, for the continuance of the institutions we hold dear. Doubly is this true in these days of peril when we must be prepared, and that quickly, to back our army and navy to the limit. Neglect in this, especially in a land so broad as ours, may well lose to us their fight in our defense, as have the shortages in tanks and airplanes brought defeat to the Allies across the sea. Financially and physically must we speedily put our railroads in perfect order and unite them for one common purpose—the welfare and safety of the people of the United States."

* Assistant to President, A. A. R.

# Railroads Ready for Emergency Buford Tells Mechanical Men

(*Continued from page* 39)

Sagstetter, chief mechanical officer, D. & R. G. W., and K. Cartwright, mechanical engineer, N. Y. N. H. & H.

## Discussion

D. Sheehan, superintendent motive power, C. & E. I., in commenting on the report of the sub-committee on wheel centers within thin walls sections said that he had found nine roads reporting in 1939 which are not mentioned in the 1940 report. This, he said, tended to reduce the value of the report through lack of cooperation of these roads with the committee. While the proportion of defects which have developed is not large, he said, the trend seems to be toward more failures and the character of the failures indicated the need for continuing the study.

H. W. Faus, engineer motive power, was inclined to question the conclusions of the subcommittee reporting on the Research Program Covering Axles, Crank Pins and Bearings, since the causes of failures were unknown in more than 64 per cent of the cases reported. He cited the experience of the New York Central in support of the statement that poor machine work was not an important factor in failures of these parts on that road during the past thirteen years. He referred to 32 failures of crank pins in the eccentric-crank keyways during 1928, 1929 on Classes J1a, b and c. The valve travel was reduced to 8½ in. and another keyway added. For the next two years there were no further failures. Crank-pin failures in the wheel-seat fillet were ended by a change from carbon steel to carbon-vanadium steel. Two older lots of locomotives of another class on which there were no crank-pin failures were followed by 104 failures in two years on two later lots of the same class. These crank pins were of carbon-vanadium steel with ¼-in. wheel-seat fillets. Investigation disclosed a change in heat treatment involving a lower normalizing and higher drawing temperature than previously employed. All but one of the failures were traced to this cause. At a later date failures in the eccentric-crank keyways again appeared. In this instance a change in the bolting to hold the eccentric crank more rigidly on the pin ended the difficulty. Another mild epidemic of failures through the wheel seat was also traced to the heat treatment.

While not considering poor machine work a factor in the failures experienced by the New York Central, Mr. Faus agreed with the committee that it could not be tolerated. He did not feel that the experience on the New York Central would justify the establishment of a definite mileage life for crank-pin service.

In commenting on the recommendation of the committee's suggestion of the desirability of holding the fibre stress in crank pins below 15,000 lb. per sq. in., Mr. Faus said that the design stresses in the crank pins of three classes of New York Central locomotives were as follows: J1, 18,350 lb.; J3, 19,030 lb.; L2, 19,200 lb.

*The report was accepted and referred to letter ballot.*

# NEWS

## I. C. C. Forbids Stock Pick-Up

### Cites letter of law, enabling it to deal death blow to rail-truck co-ordination

Because it "would seem to require resort to a legal fiction" to treat "a rural section within a 10-mile radius of a railroad station as a terminal district," the Interstate Commerce Commission in six-to-three decision (two commissioners not participating) has found unlawful railroad tariffs providing for pick-up in Illinois, Iowa and Wisconsin of livestock destined to Chicago and for like service in one or more of those states on livestock destined to East St. Louis, Ill., Indianapolis, Ind., Madison, Wis., Peoria, Ill., and Springfield. The basis on which the commission struck down the tariffs was a finding that the motor vehicle operations involved are subject to the Motor Carrier Act and thus they "are being conducted without lawful authority, since no certificate that public convenience and necessity require such operations has been sought or obtained."

Commissioner Splawn dissented, asserting that "points within a 10-mile radius of a railroad station with modern highway transportation facilities are as close to the railroad station as points one mile away were when no fast motor truck transportation over hard-surfaced highways was available." He added that "this commission should recognize modern trends and not be unduly alarmed when modern conditions require modern methods to meet them." Commissioner Mahaffie agreed with Mr. Splawn, while the dissent of Commissioner Aitchison was noted; Commissioners Lee and Alldredge concurred in the results of the majority opinion, while Commissioners Miller and Johnson did not participate. The case is docketed as No. 28216, Pick-Up of Livestock in Illinois, Iowa, and Wisconsin, and the decision holds the proceeding open for 60 days to permit cancelation of the condemned tariffs, which Mr. Splawn said had been in effect in some cases for "five or six years."

Meanwhile the majority opinion had suggested that the railroads might do the same job under joint-rate arrangements with motor carriers. In that connection it said: "A co-ordinated service which will provide for the use of trucks in conjunction with railroads in the hauling of livestock may well be desirable, but this can lawfully be accomplished by the establishment of joint rates between the railroads and connecting motor carriers. If in any instance no such motor carriers are available for the purpose, operating rights can be secured upon proof of public convenience and necessity, and there is nothing to prevent the railroads themselves from seeking such rights, either directly or through subsidiary motor carrier companies."

Commissioner Splawn had somewhat different views on the co-ordination angle of the case. "In recent years," he said, "volumes have been written about co-ordination of transportation. Railway managers have been admonished to extend and improve their service and not the least vocal of the admonitors has been the commission. In this report the commission condemns an improved and co-ordinated service because it is extended to non-urban shippers. The implication is that if the pick-up service were confined to urban shippers within city limits, the pick-up service would be lawful. It is further implied that if the city limits were extended ten miles there would be no objection to a corresponding extension of pick-up service. I do not think that terminal districts should be limited in that manner. The fact that the rail carriers generally have not in the past obligated themselves to furnish transportation for carload freight beyond their rails in rural sections is no reason why they cannot do it now. . . . The commission obviously has ample power to protect the public interest whether the service is regulated under Part I or Part II. The principal question is whether the rates are remunerative. In the absence of proof that the rates are too low, or otherwise in violation of the law, the schedules should be approved."

Outlining the background of the proceeding the majority report pointed out how first the Illinois Central and then the Chicago & North Western; Chicago, Burlington & Quincy; Chicago Great Western; Chicago, Milwaukee, St. Paul & Pacific; and Chicago, Rock Island & Pacific undertook to check the diversion of their livestock traffic to competing motor carriers by establishing the pick-up services. The latter involved a holding out to

(*Continued on page 50*)

## 5 Months N. O. I. Was $196,006,801

### 2.33 per cent return compares with $126,456,434 or 1.5 per cent last year

Class I railroads in the first five months of 1940 had a net railway operating income of $196,006,801 which was at the annual rate of return of 2.33 per cent on their property investment, according to the Bureau of Railway Economics of the Association of American Railroads and made public today. In the first five months of 1939, their net railway operating income was $126,456,434 or 1.5 per cent on investment, and in the first five months of 1930, it was $301,732,780 or 3.51 per cent.

Class I roads in May had a net railway operating income of $47,076,826 or 2.46 per cent, compared with a net of $25,172,741 or 1.32 per cent in May, 1939, and $67,790,336 or 3.41 per cent on investment in May, 1930.

Gross operating revenues for the first five months totaled $1,650,783,827 compared with $1,482,509,821 for the same period in 1939, and $2,218,877,128 for the same period in 1930, an increase of 11.4 per cent in 1940 above 1939, but 25.6 per cent below 1930. Operating expenses amounted to $1,245,074,353 compared with $1,158,958,505 for the same period in 1939, and $1,717,945,937 for the same period in 1930—7.4 per cent above the former, but 27.5 per cent below 1930.

Taxes in the five months amounted to $155,647,386 compared with $142,611,136 in the same period in 1939, and $146,785,356 in the same period in 1930; for May alone, the tax bill was $32,798,148, an increase of $4,038,777 or 14 per cent above May, 1939. Twenty-six Class I roads failed to earn expenses and taxes in the five months, of which six were in the Eastern district, eight in the Southern district and 12 in the Western district.

Gross for May amounted to $343,342,-

**CLASS I RAILROADS—UNITED STATES**

| | 1940 | 1939 | 1930 |
|---|---|---|---|
| *Month of May* | | | |
| Total operating revenues | $343,342,247 | $302,617,948 | $457,254,022 |
| Total operating expenses | 252,802,621 | 237,411,054 | 347,604,651 |
| Taxes | 32,798,148 | 28,759,371 | 30,532,352 |
| Net railway operating income | 47,076,826 | 25,172,741 | 67,790,336 |
| Operating ratio—per cent | 73.63 | 78.45 | 76.02 |
| Rate of return on property investment—per cent | 2.46 | 1.32 | 3.41 |
| *Five Months Ended May 31* | | | |
| Total operating revenues | $1,650,783,827 | $1,482,509,821 | $2,218,877,128 |
| Total operating expenses | 1,245,074,353 | 1,158,958,505 | 1,717,945,937 |
| Taxes | 155,647,386 | 142,611,136 | 146,785,356 |
| Net railway operating income | 196,006,801 | 126,456,434 | 301,732,780 |
| Operating ratio—per cent | 75.42 | 78.18 | 78.42 |
| Rate of return on property investment—per cent | 2.33 | 1.50 | 3.51 |

247 compared with $302,617,948 in May, 1939, and $457,254,022 in May, 1930. Operating expenses totaled $252,802,621 compared with $237,411,054 in the same month in 1939, and $347,604,651 in May, 1930.

Class I roads in the Eastern district for the five months had a net railway operating income of $125,814,440, a return of 2.76 per cent; for the same period in 1939, the net was $80,206,709 or 1.76 per cent, while in 1930, it was $177,734,373 or 4.15 per cent. Gross in the Eastern district for the five months totaled $838,955,628, an increase of 15.7 per cent compared with 1939, but a decrease of 25.3 per cent compared with 1930; operating expenses totaled $607.148,221, an increase of 10.4 per cent above 1939, but a decrease of 28.7 per cent under the first five months of 1930. May net in the Eastern district was $30,027,346 compared with $13,781,061 in May, 1939, and $43,275,323 in May, 1930.

The Southern district's net for the five months was $29,828,894, or 2.2 per cent. For the same period in 1939, their net amounted to $27,334,825 or 2.03 per cent, and for the same period in 1930 it was $38,895,434 or 2.76 per cent. Gross in the Southern district for the five months amounted to $225,895,427, an increase of 8.3 per cent over 1939, but a decrease of 22.7 per cent under the same period in 1930; operating expenses totaled $170,286,448, an increase of 8.9 per cent above 1939, but a decrease of 25.7 per cent under 1930. For May, the Southern district had a net of $4,878,206 compared with $4,333,914 in May, 1939, and $6,010,550 in May, 1930.

Class I roads in the Western district for the five months had a net railway operating income of $40,363,467 or 1.6 per cent. For the same period in 1939, their net amounted to $18,914,900 or 0.75 per cent, and for the same period in 1930, it was $85,102,973 or 2.92 per cent on investment. Gross in the Western district for the five months amounted to $585,932,772, an increase of 6.8 per cent above 1939, but a decrease of 27.1 per cent below the same period in 1930; operating expenses totaled $467,639,684, an increase of 3.3 per cent compared with 1939, but a decrease of 26.7 per cent under the same period in 1930. For May, the railroads of the Western district had a net of $12,171,274 compared with $7,057,766 in May, 1939, and $18,504,463 in May, 1930.

## Ralph Budd Appoints Four Assistants

Ralph Budd, transportation member of the National Defense Advisory Commission, has appointed the following men to his staff as consultants: A. T. Wood, president, Lake Carriers Association, Cleveland, Ohio; Ted V. Rodgers, president, American Trucking Associations, Inc., Washington, D. C.; F. C. Horner, New York, assistant to the chairman, General Motors Corporation; and Arthur M. Hill, president, National Association of Motor Bus Operators.

The commission has appointed Admiral Emory S. Land, chairman of the United States Maritime Commission, to coordinate shipbuilding activities—merchant and naval—in association with the production division of the commission. It is stated that Admiral Land's new duties will be in addition to his present responsibilities as chairman of the Maritime Commission.

At the same time the Chamber of Commerce of the United States has announced a program which calls for attention to a wide range of economic subjects. The Chamber's weekly "Washington Review" points out that committees and Chamber departments are already at work on them in relation to national security. Included in the phases of defense now receiving attention and which will be given closer study as the year progresses is the subject of transportation, including merchant marine. This study, it is explained, will have to do with merchant marine policy and transportation in all forms.

The weekly publication goes on to say that "appraisal of conditions in various branches of transportation and communication indicates ability to handle a considerably increased volume of traffic, although some problems are recognized as requiring attention. Steps have been taken to deal with these, notably, through purchase of new equipment by the railroads and an accelerated car repair program; provisions for mobilization of motor transport to meet any emergency requirements; and steps to handle increased needs for air transport and airport facilities."

Associations in the transportation field are preparing to meet any demands that may arise and to cooperate fully with the National Defense Commission and state and local authorities, the publication concludes.

## President Approves War Department Civil Bill

President Roosevelt has signed H. R. 8668, the War Department civil appropriation bill carrying $67,365,310 for river and harbor improvement work and $15,000,000 for the beginning work on a new set of locks for the Panama Canal, for the fiscal year ending June 30, 1941.

## Retirement Board Relinquishes New Home to Defense Commission

The National Defense Advisory Commission will be housed in the new Washington, D. C., building which was originally designed to be the home of the Railroad Retirement Board and the Social Security Board. At the request of the President these agencies have agreed to remain in their present quarters, thus making the new building available to the Defense Commission when it is completed.

## May Locomotive Shipments

May shipments of railroad locomotives totaled 43 as compared with 54 in April and 20 in May, 1939, according to reports received from builders by the Bureau of the Census, United States Department of Commerce. Shipments for this year's first five months totaled 204 locomotives as compared with 107 in the same period last year. Unfilled orders at the end of May totaled 152 locomotives as compared with 170 at the end of April and 169 as of May 31, 1939.

The aforementioned May total of 43 locomotives shipped included two steam locomotives, 33 Diesel-electrics and two of other types for domestic service, and six steam for export; the 204 shipped in this year's first five months included 21 steam, 146 Diesel-electrics and nine of other types for domestic service and 28 steam for export. Included in the 152 on order as of May 31 were 70 steam, 54 Diesel-electrics and two of other types for domestic service and 26 steam for export.

Data supplied by the Car Service Division, Association of American Railroads, on locomotive building in railroad shops show that 34 locomotives, including 20 steam and 14 electrics, were thus produced during this year's first five months; in the comparable 1939 period, railroad shops turned out 24 locomotives, including seven steam and 17 electrics. As of June 1 there were unfilled orders in railroad shops for 24 locomotives—18 steam and six electrics.

## "All Freight" Tariffs Suspended

The Interstate Commerce Commission has suspended from July 1 until February 1, 1941, schedules wherein the Chicago, Rock Island & Pacific is proposing to establish so-called "all freight" or "all commodity" rates from Chicago, East St. Louis, Ill., and St. Louis, Mo., to Santa Rosa, N. M. The proceeding, docketed as I. & S. No. 4806, has been assigned for hearing before Examiner Archer at the Hotel Morrison, Chicago, on July 18.

## I. C. C. Will Hereafter Print Only Interpretive Motor Reports

Hereafter only those motor carrier reports of the Interstate Comerce Commission which involve "an interpretation of the law, or of a tariff, or of a commission ruling, or a discussion of the legality of any practice or service of carriers," will be printed in full in the permanent series of Motor Carrier Reports. The action of the commission in that connection was taken on May 7, and revealed in a notice to the public issued by I. C. C. Secretary W. P. Bartel on June 28.

Secretary Bartel's notice states that the motor reports which are not printed in full in the permanent series will, however, be summarized there in an appendix. Meanwhile when released in mimeographed form, they will be designated as reports which are not to be printed.

## Equipment Depreciation Orders

Equipment depreciation rates for five railroads, including the Reading and Detroit, Toledo & Ironton, have been prescribed by the Interstate Commerce Commission in a new series of sub-orders and modifications of previous sub-orders in No. 15100, Depreciation Charges of Steam Railroad Companies. The composite percentages for all equipment, which are not prescribed rates, range from 2.76 per cent for the Reading to 4.3 for the South Georgia, the higher composite figure of 10 per cent for the Union of Oregon being merely the prescribed rate for that road's locomotives other than steam, the only class of equipment covered by the sub-order applying to the Union.

The Reading's composite percentage of

2.76 is derived from prescribed rates as follows: Steam locomotives, 2.79 per cent; other locomotives, 3.84 per cent; freight-train cars—owned, 2.76 per cent, leased, 2.57 per cent; passenger-train cars, 2.54 per cent; floating equipment, 2.48 per cent; work equipment, 4.6 per cent; miscellaneous equipment—owned, 10.11 per cent, leased, 5.29 per cent. The composite percentage for the D. T. & I. is 4.07, derived from prescribed rates as follows: Steam locomotives—new, 3.04 per cent, secondhand and rebuilt, 6.03 per cent; freight-train cars—new, 3.57 per cent, secondhand and rebuilt, 4.13 per cent; passenger-train cars—secondhand and rebuilt, 4.96 per cent; work equipment, 3.49 per cent; miscellaneous equipment, 17.12 per cent.

## Freight Car Loading

Because of the July 4 holiday this issue of *Railway Age* went to press before the Association of American Railroads had made public the car loading figures for the week ended June 29.

As reported in last week's issue, the revenue freight car loadings for the week ended June 22 totaled 728,096, and the summary for that week, as compiled by the Car Service Division, A. A. R., follows:

**Revenue Freight Car Loading**

For Week Ended Saturday, June 22

| Districts | 1940 | 1939 | 1938 |
|---|---|---|---|
| Eastern | 154,284 | 131,312 | 118,424 |
| Allegheny | 155,310 | 120,408 | 99,938 |
| Pocahontas | 48,387 | 43,422 | 35,416 |
| Southern | 97,665 | 90,615 | 79,998 |
| Northwestern | 121,644 | 97,224 | 78,212 |
| Central Western | 106,390 | 109,422 | 100,266 |
| Southwestern | 44,416 | 46,131 | 46,534 |
| Total Western Districts | 272,450 | 252,777 | 225,012 |
| Total All Roads | 728,096 | 638,534 | 558,788 |
| Commodities | | | |
| Grain and grain products | 33,656 | 46,981 | 41,985 |
| Live stock | 10,553 | 10,272 | 10,582 |
| Coal | 123,260 | 96,835 | 86,674 |
| Coke | 10,604 | 5,864 | 4,098 |
| Forest products | 34,237 | 30,527 | 26,631 |
| Ore | 68,209 | 41,417 | 22,771 |
| Merchandise l.c.l | 148,782 | 151,864 | 145,466 |
| Miscellaneous | 298,795 | 254,774 | 220,581 |
| June 22 | 728,096 | 638,534 | 558,788 |
| June 15 | 712,445 | 633,955 | 555,519 |
| June 8 | 702,571 | 630,060 | 553,854 |
| June 1 | 639,126 | 563,309 | 502,617 |
| May 25 | 687,490 | 623,542 | 562,076 |
| Cumulative Total, 25 Weeks | 16,154,069 | 14,602,396 | 13,641,752 |

*In Canada.*—Carloadings for the week ended June 22 totaled 59,400, as compared with 56,876 in the preceding week and 45,366 a year ago, according to the summary of the Dominion Bureau of Statistics.

| | Total Cars Loaded | Total Cars Rec'd from Connections |
|---|---|---|
| Total for Canada: | | |
| June 22, 1940 | 59,400 | 25,840 |
| June 15, 1940 | 56,876 | 24,973 |
| June 8, 1940 | 57,100 | 24,353 |
| June 24, 1939 | 45,366 | 19,618 |
| Cumulative Totals for Canada: | | |
| June 22, 1940 | 1,243,137 | 616,426 |
| June 24, 1939 | 1,070,169 | 522,288 |
| June 25, 1938 | 1,101,146 | 523,709 |

## Hearing on Petroleum Rates in Western Trunk Line Territory

The Interstate Commerce Commission has set July 22 as the date for hearings at St. Louis, Mo., before Examiner Archer in the I. & S. No. 4791 proceeding which involves suspended schedules wherein the Chicago, Rock Island & Pacific, the Chicago & North Western and other roads are proposing to reduce carload rates on petroleum products from pipe-line and water terminals in Western Trunk Line Territory to various destinations in that territory.

## A. A. R. Anti-Trust Argument Is Postponed Until Fall

Argument before the federal district court for the District of Columbia on the question of whether the government's anti-trust case against the Association of American Railroads, growing out of the passage by that body of a resolution prohibiting through routes and joint rates with motor carriers, should be continued or dismissed, has been postponed from June 27 until some time in the fall term. The postponement was not asked for by the carriers, who are contending that the issues involved are moot because of the rescinding of the resolution, details of which were given in the *Railway Age* of June 15, page 1073, but was due to the inability of the court and the government attorneys to agree on a date at this time.

## Johnson Would Exempt Crude-Oil Lines from His Pipe-Line Bill

An amendment which would exempt pipe lines "intended for use only in the transportation of crude petroleum" from the provisions of the Johnson pipe-line bill (S. 3753) has been offered by Senator Johnson, Democrat of Colorado, sponsor of the measure. The bill which is now pending before the Senate committee on interstate commerce would require pipe lines to obtain certificates of convenience and necessity from the Interstate Commerce Commission for extensions and new construction.

## New Lessee for N. & W. Norfolk Docks

The piers, wharves and warehouses of the Norfolk & Western at Lambert Point and Sewalls Point (Norfolk, Va.), heretofore under lease to the Lamberts Point Terminal Corporation, have been leased, effective July 1, to the newly-organized Lambert's Point Docks, Inc.

The new corporation will be headed by W. D. Dimmitt, as president and general manager. Mr. Dimmitt recently resigned as general foreign freight agent of the Norfolk & Western. In addition to Mr. Dimmitt, officers are: F. R. Barrett, vice-president, and W. H. Maher, secretary and treasurer, all of Norfolk.

## Rail-Labor National Defense Committees

Committees to cooperate in the disposition of problems of mutual interest which may arise from the national defense program have been appointed by the Association of American Railroads and the Railway Labor Executives' Association, according to a joint announcement made after June 28's Washington, D. C., meeting of the A. A. R. board of directors. The railroad committee, appointed by the A. A. R. board, is composed of A. A. R. President J. J. Pelley, chairman; M. W. Clement, president of the Pennsylvania; E. E. Norris, president of the Southern; and E. J. Engel, president of the Atchison, Topeka & Santa Fe. The labor committee, named by R. L. E. A., is headed by R. L. E. A. Chairman J. A. Phillips, president of the Order of Railway Conductors, and it includes also George M. Harrison, president of the Brotherhood of Railway Clerks; B. M. Jewell, president of the Railway Employees Department, American Federation of Labor; and J. J. Delaney, president of the Masters, Mates & Pilots Association of America.

It was indicated that the functions of the special committees would not supersede or replace in any way the regular machinery for dealing with hours, wages and working conditions of railroad employees; their work will be confined to matters arising under the defense program, and in that connection they will be prepared to cooperate with Ralph Budd, president of the Chicago, Burlington & Quincy, who is the transportation member of the National Defense Commission.

## Wabash-U. P. Shorten St. Louis-Pacific Coast Line

The Wabash-Union Pacific on June 30, shortened the running time of the Pacific Limited between St. Louis, Mo., and Los Angeles, Cal., and San Francisco, 2 hr. 7 min. The train now leaves St. Louis at 4:05 p.m. instead of 1:58 p.m. and Kansas City at 10 p.m. instead of 7:30 p.m. and arrives in Denver, Colo. at 8 a. m. the next morning instead of 7:40 a.m. and Cheyenne, where it connects with the Pacific Limited from Chicago, at 11:05 a.m. as formerly.

## U. P. and Army Test Airplane Reporting System

An airplane reporting system, such as might be put into effect to warn of the approach of hostile planes in time of war, was tested on June 25 by Seventh Corps area army officers in cooperation with the Union Pacific, with results described by Major General P. P. Bishop as being "highly satisfactory."

As army aviators piloted three ships from Cheyenne, Wyo., to Omaha, Neb., the Union Pacific assigned employees to report progress of the flight, using the Union Pacific's telephone dispatcher circuit. The experiment was chiefly a test of communications rather than one of detecting planes, and the principal purpose was to determine how fast and efficiently reports of the flight could be transmitted to a central control point (in this case, the chief dispatcher's office in Omaha). It also determined whether Union Pacific workers and the dispatcher circuit could handle the messages without interference with regular duties.

Fifty stations, including Omaha and Cheyenne, along the 492 miles of roadbed between Cheyenne and Lane, 14 miles west of Omaha, participated in the trial as the planes, from Fort Riley, Kan., flew at altitudes of 5,000 to 7,000 ft. At these points observers telephoned the place and time of the planes, and officers at the central station then charted their approximate course and speed, predicting the time they

should arrive at other points on the flight.

Minimum time of reporting, from the time the planes were spotted until the information was in the Omaha office, was 12 seconds, this being reported from Alda, Neb. The longest time for reporting, 78 seconds, was from the station at Odessa, Neb. Grand Island's time was 22 seconds, North Platte's 30 seconds and Cheyenne's 90 seconds.

In charge of the experiment was Captain W. H. Dunham. Union Pacific arrangements were handled by F. A. Coulter, superintendent of telegraph. The reports were cleared through C. A. Laughlin, train dispatcher, who handled all of his regular duties as well.

## I. C. C. Forbids Stock Pick-Up

(*Continued from page 47*)

pick up straight or mixed shipments of livestock aggregating 1,000 lb. or more; or to pay an allowance of three cents per 100 lb. when such shipments were delivered to the carrier in vehicles of shippers. The railroads contended at the hearings that the pick-up service had been a factor in reversing the downward trend in their livestock traffic, and asserted that "its continuance is essential if this traffic is not to be lost completely and irretrievably."

After next doing what it evidently regarded as a job of cutting to the core of the thing, the majority report had this to say: "The fact of the matter is that what respondents have here really done is to reduce their line-haul rates on livestock by the process, not of cutting the rate itself, but of adding free nonrailroad service which would otherwise be at the expense of the shippers; and the extent of the territory covered by this free service is determined, not by any logical application of the term 'terminal facilities,' but by the amount of the reduction in the rate which is deemed necessary to meet competition and which respondents believe they can afford to make. If the reasoning be accepted that the motor vehicle operations in question are to be regarded as 'terminal facilities' of the railroads and hence subject to the provisions of Part I rather than Part II, it is possible of logical extension which will enable the railroads to conduct far-reaching motor vehicle operations without being subject to the restrictions which Part II places on competing motor carriers. We do not believe that Congress contemplated any such possibility when in 1935 it attached the exception to the definition in section 203 (a) (14), and that this exception should not be given any broader construction than can be supported by previously prevailing railroad practice and custom."

Among the contentions of protestants to the railroad tariffs was one to the effect that the pick-up service was not in actual practice confined to the areas specified in the tariffs. Noting this, the majority report in closing suggested that even if the service could be regarded as subject to Part I, "it would be open to the objection that the tariffs providing for it admittedly contain ambiguous, conflicting and inconsistent items. . . . We have consistently found unlawful the maintenance of tariff provisions ambiguous in terms or dependent upon the knowledge or judgment of carriers' agents." On this point Commissioner Splawn found "no proof that the station agents are incompetent or dishonest, or that the 'policing' problem would be materially different from that presented in situations where pick-up and delivery service is authorized on less-than-carload freight within defined limits."

### New Haven Case Is Reargued

The reargument of the New York, New Haven & Hartford reorganization case before the entire Interstate Commerce Commission on June 27 and 28 turned out to be little more than a restating of the various parties' positions in the earlier argument. Some 32 separate presentations were made for and against the commission's final plan of reorganization for the road, details of which were given in the *Railway Age* of April 20, page 715. At that time the commission refused to permit the Old Colony to be reorganized as a part of the New Haven, saying that it could not be included in the new company because of its present financial plight.

C. A. Coolidge, representing the Old Colony, told the commission that he was not seeking to delay the reorganization of the New Haven. Rather, he insisted, the Old Colony wanted to see the New Haven come out of reorganization, but the Old Colony wanted to come out of reorganization with the New Haven and as a part of it.

D. B. MacCormack, appearing for the Commonwealth of Massachusetts and the Special Railroad Commission of Massachusetts, asked the commission to reopen the case in order that his group might submit additional data to show that the Old Colony has earning power and should be included in the reorganized New Haven.

John L. Hall, representing the New Haven, the debtor company in the proceeding, urged the commission to not delay the reorganization, taking the position that the company is now ready to come out of bankruptcy. A similar view was expressed by Eugene Untermeyer, attorney for the independent bondholders reorganization committee, and Edwin S. S. Sunderland, counsel for the insurance group.

H. S. Drinker, appearing for the Pennsylvania, asked for some recognition for the common stock, of which his client holds some 319,000 shares or 22 per cent of the total amount outstanding. He told the commission that Division 4, in promulgating the final plan, took too short a view of things in according no recognition at all to the equity holders. In his opinion, the New Haven will come back into its own and be in a position to earn sufficient dividends to pay the holders of the common stock.

### Attorney General Releases Monograph on I. C. C.

The Attorney General's Committee on Administrative Procedure has made public a monograph on the Interstate Commerce Commission which discusses in detail the administrative procedure of this regulatory agency. The monograph, which is in two volumes and covers some 240 pages, is one of a series of studies submitted to the committee by the investigating staff working under the director, Walter Gellhorn. Another volume, "Railway Labor", which discussed the administrative procedure of the National Railway Adjustment Board and the National Mediation Board has already been released, as noted in the *Railway Age* of May 18, page 872.

Public hearings before the committee for the purpose of discussing the I. C. C. monograph will be held on July 10 in Washington, D. C. A report of the hearings on the first monograph on "Railway Labor" was given in last week's issue.

A footnote in an early chapter of the monograph explains that it is "far from exhaustive of the procedural processes of the Interstate Commerce Commission". "Many of the commission's functions", it is further pointed out, "are completely ignored; some others are dealt with quite cursorily. Attempt has been made to consider the adjudication work of the Bureau of Formal Cases with relative thoroughness, for it is this Bureau that many of the more common procedural patterns of the administrative process originated. If one were bound to follow the loose thought of those who speak and write of 'the procedure' of the Interstate Commerce Commission, perhaps the work of the Bureau of Formal Cases would be considered to the exclusion of the commission's other 14 bureaus."

The footnote concludes by saying that "The commission's various procedures are so numerous and complex that limitations of time make exhaustive study impossible. Accordingly, except for the Bureau of Formal Cases, the principal procedures have been discussed only in sufficient detail to illuminate those aspects which are thought of especial significance from the standpoint of a general study of administrative procedure."

### Good News from Britain

Assurance that the British railways are carrying on at the old stand with their usual efficiency, despite the fortunes and threats of war, comes in a news release received this week, issued by the British Railways' Press Office and sent to us by the British Railways' Research Service (C. E. R. Sherrington, secretary).

"During the past few weeks," says the release, "the energy of the railways has been evident, especially in the smooth working of the numerous troop specials for the British Expeditionary Force, which has won the thanks of the Secretary of State for War on behalf of the Army Council, the Minister of Transport, and of the public.

"It says much for the resourcefulness of the railways, that while this special movement was in progress involving the running of 620 trains carrying over 300,000 troops in the space of eight days, the railways also carried 20,000,000 passengers and 6,000,000 tons of freight, in addition to many millions of workers who travel daily between their homes and workplaces.

"On two recent Sundays, the railways undertook the transfer of 56,000 school

children and adults. This required the running of 86 special trains. Other specials have transported Dutch, Belgian, and French people and their children who have come over to seek sanctuary in this country. Some of these visitors were unable to speak more than a few words of English, and special interpreters were arranged.

"Other unusual demands were made on the railways, to carry Americans to Ireland en route to the United States; aliens to concentration centers, and prisoners of war. Increasing supplies of materials for munition factories, of coal from the collieries, and the movement of livestock from certain areas also mean additional hard work for the railways. The formation of National Defense Volunteer Units from railway workers throughout the country gives railwaymen an opportunity to show their grit and determination to carry on.

"A million and a quarter freight vehicles and 20,000 locomotives are supporting the industrial drive. Coal is being carried to the furnaces; steel and new machinery to the munition factories, and food, guns and ammunition supplied to our fighting services. The railways are going to it."

### 100 Per Cent Rule on "No-Bill" Coal Cars Reinstated

Because the holding of cars under load with coal unconsigned "represents a waste of potential transportation capacity" at a time when "it is necessary that all practical means be taken to obtain maximum efficiency in the use of freight car equipment," W. C. Kendall, chairman of the Car Service Division of the Association of American Railroads, has notified the chief operating officers of all coal-loading roads that the so-called 100 per cent rule covering the placement of cars for coal loading will be reinstated effective July 15. The rule, which was suspended on February 29, provides that no open-top cars shall be placed at a mine when the number of "no-bill" open-top cars already held at such mine is equal to or in excess of its daily rated capacity; but it can not be interpreted as permitting increased holding of "no-bills" in cases where mines may already be restricted to a lesser number of such holdings than permitted under the 100 per cent rule.

After noting how loading in open-top equipment is increasing, with every indication that it will continue to do so until the Fall peak is reached, Mr. Kendall's circular called attention to assurances which have been given to the government and to shippers that the railroads are "ready and able to handle without car shortage" the traffic increases involved in the national defense program. The aforementioned necessity for obtaining maximum efficiency in the use of freight-car equipment results from a determination "to assure the successful carrying out of this plan," the Car Service Division chairman went on.

Next comes a reference to the "latest reports" which showed a total of 41,377 "no-bill" cars held at coal mines, followed by citations of recent car loading statistics and Shippers Advisory Board Estimates of third-quarter loadings—from which, Mr. Kendall said, "it is apparent that it is none too soon for the railroads to take steps to conserve the use of open-top cars for the purpose for which they were designed, that is, the transportation of freight." Meanwhile, "it is believed that the coal industry will recognize a mutual interest in obtaining maximum transportation efficiency and will fully cooperate to that end."

* * *

Rail oddities
3 CENTS
TO BUY A THREE CENT POSTAGE STAMP TAKES ALL THE INCOME THE RAILROADS RECEIVE FOR HAULING AN AVERAGE TON OF FREIGHT THREE MILES
APPLE PIE IS THE MOST POPULAR DESSERT SERVED ON RAILROAD DINING CARS
THE BUILDING OF AN AVERAGE RAILROAD FREIGHT CAR REQUIRES MATERIALS FROM 31 STATES AND PROVIDES EMPLOYMENT EQUAL TO THE WORK OF ONE MAN FOR A YEAR
ASSOCIATION OF AMERICAN RAILROADS

**The A. A. R. Is Offering Free of Charge to Publications a Series of Cartoons Such as the One Above—Stereotypes or Mats Will Be Supplied in Any Size**

### The Canadian Roads in May

In May the Canadian Pacific had gross revenues of $13,511,521 (+ $1,517,226 over last year), operating expenses of $11,047,137 (+ $959,798) and net operating income of $2,464,383 (+ $557,428). For the five months, revenues were $61,192,964 (+ $9,739,277), expenses were $51,480,412 (+ $4,314,350) and operating net was $9,712,951 (+ $5,424,926).

The Canadian National's gross in May was $20,281,335 (+ $3,439,069), expenses $16,769,401 (+ $1,400,169) and operating net $3,511,934 ($2,038,900). For the five months operating revenues were $91,321,614 (+ $18,829,605), expenses $80,682,738 (+ $7,697,408) and operating net $10,638,876 (as against a deficit of $493,321 in the first 5 months of 1939).

### Rate and Classification Data Now Due August 1

The Interstate Commerce Commission has further postponed from July 1 until August 1 the deadline for the furnishing of information called for in the orders issued on January 9 in the Nos. 28300 and 28310 general investigations of the class rate structure and the consolidated freight classification. The information called for in these orders which the railroads are seeking to have modified was outlined in the *Railway Age* of January 20, page 170.

# Construction

CANADIAN NATIONAL.—A contract has been awarded to the Saskatoon Contracting Company, Ltd., Saskatoon, Sask., amounting to approximately $100,000, for the construction of a 42-ft. by 96-ft., brick, tile and concrete power house and a reinforced concrete chimney 120 ft. high in Saskatoon. The chimney will be lined with fire brick to a height of 70-ft. and the outside diameter will be 10-ft. at the base and 6-ft. at the top.

GREAT NORTHERN.—The Bureau of Reclamation, Coulee Dam, Wash., has awarded a contract amounting to $109,990, to A. A. Pendergast and Associates, and the Industrial Contracting Company, Minneapolis, Minn., for the construction of piers and abutments for the Kettle Falls railroad bridge across the Columbia river near Kettle Falls, Wash. The new bridge will replace an old railroad bridge at Marcus, Wash., the site of which will be submerged by the reservoir in connection with the Grand Coulee project on Columbia river.

The bridge will be of the riveted cantilever single-track type 1,227-ft. long with a central (anchor) span 1,608 ft. in length, two cantilever arms of 3 panels, each totaling 114 ft. in length, and two suspension spans, one at the west end of the bridge 152 ft. long, and one at the east end of the bridge 228 ft. long. The deck will be an open-type timber deck, using creosoted Douglas fir bridge ties 8 in. by 12 in. by 10 ft., spaced on 12 in. centers. The relocation of tracks in connection with this project was described in the *Railway Age* of June 22, on page 1141.

MINNEAPOLIS, ST. PAUL & SAULT STE. MARIE.—A contract amounting to approximately $40,000, has been awarded the James Leck Company, Minneapolis, Minn., for the construction of a freight house, transfer platform and roadway at the Shoreham Yard in North Minneapolis.

NORTHERN PACIFIC.—A contract has been awarded the J. W. Bailey Construction Company, Seattle, Wash., for remodeling a fruit and vegetable packing warehouse and the construction of a 40-ft. by 73-ft. addition at Kennewick, Wash. The addition will be of frame construction with concrete foundations and covered platforms. The cost of the entire project, including electric lighting, power wiring and plumbing, will be about $22,000.

SOUTHERN PACIFIC.—A contract has been awarded to W. S. Crawford Company and T. M. Brown and Son, Dallas, Tex., for the construction of a railroad bridge for a highway underpass in Burton, Tex. The double-track bridge will consist of three I-beam spans, a center span 37-ft. long, and two approach spans each 30 ft. long, supported on spread-footing type reinforced concrete piers and abutments. The bridge will have a ballast deck with a treated timber floor and will provide a clear roadway width of 30-ft. for the highway beneath. The cost of the bridge, including work to be done by railroad forces, will be approximately $30,200.

# Equipment and Supplies

## Equipment in Better Demand

### June orders for freight cars and locomotives up sharply, 6-Months' totals rise

The railroads in June ordered 31 locomotives (18 steam and 13 Diesel-electric), according to the reports published in the weekly issues of *Railway Age* during the month. This total compares with orders for 20 locomotives placed in May, this year, and of 8 ordered during June, 1939.

For the first six months of the current year, *Railway Age* has reported orders for 187 locomotives (92 steam and 95 Diesel-electric), as compared with 152 ordered in the first half of 1939.

Freight cars ordered in June totaled 4,235, as compared with 2,081 in May and 1,324 in June, 1939.

For the six months, freight car orders reported by *Railway Age* totaled 10,585, as compared with 9,077 in the comparable 1939 period.

Passenger car activity continues at a lower level than in the first half of 1939, only 2 such vehicles having been ordered in June and the six months' total (23) is far below the total of 135 reported in the first half of 1939.

Orders for steel rails in June mounted to 55,000 tons, as compared to only 13,200 tons in June, 1939. For the first half of the current year, rail orders have totaled 132,392 tons, as compared with over a half-million tons in the first half of 1939.

### LOCOMOTIVES

THE SOUTHERN PACIFIC is inquiring for twenty 4-8-4 type locomotives.

THE SEABOARD AIR LINE has placed an order with the Ross & White Company for a locomotive coaler to be installed at Cayce, S. C.

### FREIGHT CARS

THE SOUTHERN PACIFIC is inquiring for 2,000 freight cars including 1,500 box and 500 automobile cars.

THE ILLINOIS CENTRAL is inquiring for 3,000 freight cars including 1,000 40-ft. 6 in., 40-ton box; 1,000 40-ft. 6 in., 50-ton box; 500 50-ft. 40-ton box and 500 automobile cars.

THE CHESAPEAKE & OHIO has ordered 1,000 50-ton box cars and 100 caboose cars as follows:

300 50-ton box cars, American Car & Foundry Company

200 50-ton box cars, General American Transportation Corporation

200 50-ton box cars, Mt. Vernon Car Manufacturing Company

200 50-ton box cars, Pullman-Standard Car Manufacturing Company

100 50-ton box cars, Greenville Steel Car Company

50 caboose cars, St. Louis Car Company

50 caboose cars, Magor Car Company

Inquiry for this equipment was reported in the *Railway Age* of June 22.

### PASSENGER CARS

THE SOUTHERN PACIFIC is asking for prices on 121 passenger cars divided into three inquiries as follows:

FIRST INQUIRY

2 baggage postal
2 baggage
2 articulated diner-kitchen-coffee shop units (6 cars)
2 parlor-observation
8 chair
2 articulated chair units (4 cars)

SECOND INQUIRY

9 baggage postal
2 postal-storage
3 postal
17 baggage
2 articulated counter-diner-kitchen-dormitory units (4 cars)
5 dining
7 lounge

THIRD INQUIRY

50 chair

### SIGNALING

THE LOUISVILLE & NASHVILLE has placed an order with the General Railway Signal Company covering materials for an automatic interlocking at Frascati, Mobile, Ala. Apparatus includes one 6-ft. by 6-ft. housing completely wired, equipped with Type-K relays, Type-K transformers and Type-BQX rectifiers; two skate machines for controlling 3 derails; one Type-F dwarf signal and two Type-D color-light signals.

THE LOUISVILLE & NASHVILLE has placed an order with the General Railway Signal Company covering materials for a coded, Type-H, Class-S, Size-6, two-wire c. t. c. system for the remote control of a railroad grade crossing of Illinois Central with L. & N. at West Point, Ky. A desk-type control machine, having 3 working levers, is located at Strawberry, Ky. The equipment includes one 6 ft. by 6 ft. housing completely wired, and equipped with Type-K relays, rectifiers, transformers and c. t. c. relay cabinets.

THE LEHIGH & NEW ENGLAND has placed an order with the General Railway Signal Company covering materials for a coded Type-F, Class-M, Size-8, three-wire c. t. c. system for the remote control of signals and switches on two tracks merging into one through a tunnel at Lansford, Pa. The control machine, located at Arlington, Pa., has 4 working levers. Included in the order are: one 6-ft. by 6-ft. housing, completely wired and equipped with Type-K relays, rectifiers, transformers, c. t. c. relay cabinets; two double-door low-welded steel cases; 3 Model-5D switch machines; and 11 Type-SA two-indication, plug-coupled signals.

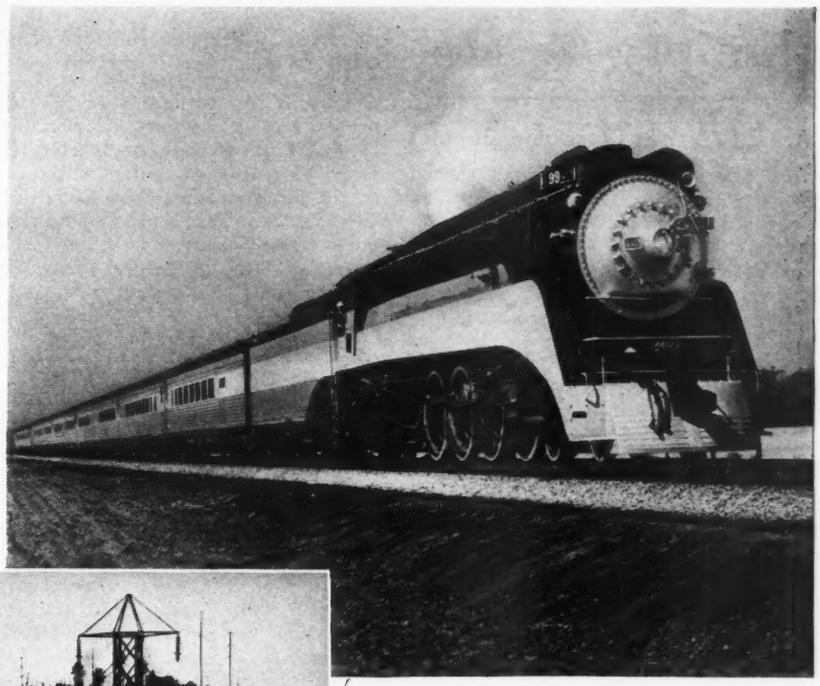
*Continued on next left-hand page*

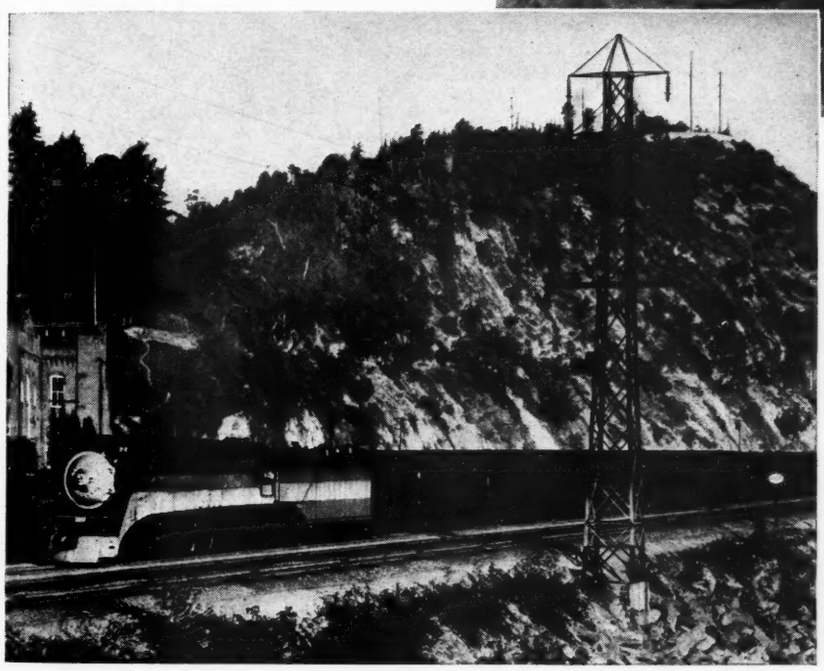
## Domestic Equipment Orders Reported in Issues of The Railway Age in June 1940

### (Excluding June 1)

| *Date* | *Name of Company* | *No.* | *Type* | *Builder* |
|---|---|---|---|---|
| | **LOCOMOTIVES** | | | |
| June 8 | Missouri Pacific ..... | 2 | Diesel-electric | Electro-Motive Corp. |
| | | 2 | Diesel-electric | American Locomotive Co. |
| | | 2 | Diesel-electric | Baldwin Locomotive Works |
| | | 2 | Diesel-electric | General Electric Co. |
| | | 1 | Diesel-electric | H. K. Porter Co. |
| | | 1 | Diesel-electric | Davenport-Besler Corp. |
| | | 1 | Diesel-electric | Whitcomb Locomotive Works |
| June 15 | Western Maryland ..... | 12 | 4-6-6-4 | Baldwin Locomotive Works |
| June 15 | Detroit, Toledo & Ironton.. | 4 | 2-8-2 | Lima Locomotive Works |
| June 29 | Illinois Central ..... | 1 | Engine Coaler | Ross & White Co. |
| June 29 | Tennessee Central ..... | 1 | Engine Coaler | Ross & White Co. |
| June 29 | Atchison, Topeka & Santa Fe | 2 | Diesel-electric | Electro-Motive Corp. |
| | **FREIGHT CARS** | | | |
| June 8 | Missouri Pacific (Gulf Coast Lines) ..... | 100 | Stock | American Car & Foundry |
| | Missouri Pacific (Intl.-G. Northern) ..... | 100 | Stock | American Car & Foundry |
| | Missouri Pacific ..... | 30 | Covered Hopper | Mt. Vernon Car |
| June 8 | Tennessee Coal Iron & Railroad ..... | 10 | Gondola | Pullman-Standard |
| June 15 | Baltimore & Ohio..... | 100 | Covered Hopper | Company Shops |
| June 15 | Cambria & Indiana ..... | 200 | Coal | Bethlehem Steel Co. |
| June 15 | Central of Georgia..... | 15 | Covered Hopper | Pullman-Standard |
| June 15 | Great Northern ..... | 500 | Box | Pressed Steel |
| | | 500 | Box | Pullman-Standard |
| June 22 | Minneapolis, St. Paul & Sault Ste. Marie ..... | 400 | Box | Pullman-Standard |
| | | 100 | Auto Box | Pullman-Standard |
| June 22 | Detroit, Toledo & Ironton.. | 50 | Covered Hopper | Greenville Steel Car |
| June 22 | Gulf, Mobile & Ohio..... | 1,000 | Box | American Car & Foundry |
| | | 250 | Hopper | Pullman-Standard |
| June 29 | Wabash ..... | 5 | Covered Hopper | Pullman-Standard |
| June 29 | New York, Chicago & St. Louis ..... | 50 | Gondola | Bethlehem Steel Co. |
| | | 75 | Flat | Bethlehem Steel Co. |
| | | 250 | Gondola | Pullman-Standard |
| | | 200 | Gondola | General American |
| | | 300 | Box | American Car & Foundry |
| | **PASSENGER-TRAIN CARS** | | | |
| June 8 | Missouri Pacific ..... | 2 | Coach | St. Louis Car Co. |

# FAMOUS TO PASSENGERS AS *Daylights*





# FAMOUS TO SHIPPERS AS *"Overnights"*

**To meet the requirements of shippers for "speed" some of the more progressive railroads are now using the same locomotives for both heavy duty passenger and high speed freight service.**

**This trend is becoming increasingly popular with shippers as a time saver and with the railroads as a revenue producer.** *Photo courtesy Southern Pacific Company.*

**LIMA LOCOMOTIVE WORKS** LIMA LOCOMOTIVE WORKS INCORPORATED **INCORPORATED, LIMA, OHIO**

# Supply Trade

## A. C. F. Issues Illustrated Report

The American Car & Foundry Company has issued its annual report for the fiscal year ended April 30, 1940, relating in simple terms the financial position of the company at the end of the period and its progress during the year.

More than that though, the report presents attractive photographs of the company's principal products, together with explanatory text which relates just how modern the product is and why it is something for which a real demand exists. For example, a picture of a light weight box car is shown, with the following text:

"Without doubt, the greatest potential advance in freight equipment lies in the development of lightweight designs. The A. C. F. lightweight box car, shown here, cuts about 8,000 lb. from standard practice with no sacrifice in strength or capacity and saves about $72 a year in hauling costs."

The pictures include interiors of lightweight passenger trains built for the Missouri Pacific, coaches for the D. & H., dining cars for the Pennsylvania and freight equipment for the L. & A., the A. T. & S. F., the I. C., the N. P., the Erie, the E. J. & E., the D. & H., the D. L. & W., the C. & O., the L. & N. and the L. N. E. In addition, there are shown rail cars for the Susquehanna and one of the G. M. & N.'s "Rebel" trains, a sub-chaser built for the U. S. Navy, pontoons and a tank built for the Army and a Carter carburetor (built by an A. C. F. subsidiary).

The report shows gross sales for the year at 35.9 million dollars and a loss from operations, after depreciation, of $652,398. Dividend and other income was more than sufficient to meet all other charges, but not entirely to obliterate the moderate loss from operations; so the net showing for the year, after all charges, was a loss of $10,776.

**B. S. Woodman** has been appointed special representative of the **Roller-Smith Company,** with headquarters at Bethlehem, Pa.

**W. C. Morgenstern** has been appointed assistant chief engineer of the **Copperweld Steel Company,** with headquarters in the company's new plant at Warren, Ohio.

According to an announcement issued by **Manning, Maxwell & Moore, Inc.,** the name of the **Ashcroft American Gauge Division** has been changed to **Ashcroft Gauge Division,** effective immediately.

**Harold Aylesford Browne,** manager of the transportation department of the Shell Oil Company, died on June 27 of a heart attack. Mr. Browne at one time served as secretary to the president of the New York, New Haven & Hartford.

**Marshall D. Raymond,** district sales manager of the **American Locomotive Company,** New York, with headquarters at San Francisco, Cal., has been transferred to Cleveland, Ohio, and has been succeeded by **Stephen G. Harwood,** formerly representative at Chicago.

**John W. Alden** has been appointed mill metallurgist for the steel and tube division of the **Timken Roller Bearing Company.** Mr. Alden was employed as metallurgist for the United Steel Company, the Central Alloy Steel Corporation, and Republic Steel Corporation before becoming a member of the staff of the Timken Roller Bearing Co.

**S. T. Whitbeck,** auditor of the air conditioning department of the **General Electric Co.,** at Bloomfield, N. J., has been appointed auditor of receipts, with headquarters at Schenectady, N. Y. Mr. Whitbeck succeeds **Jacob Schuler,** who has retired after 43 years of service with the company.

**The Air Reduction Company** has just completed the construction of an acetylene plant at West Berkeley, Cal. The new plant is located just a short distance from the site of the old plant, and will include all modern equipment for the manufacture of acetylene and the filling, compressing and the handling of cylinders.

**George D. Casgrain,** vice-president of the **Griffin Wheel Company,** Chicago, who retired from active service on July 1, under the company's retirement plan, and who has been elected vice-president of the **Marquette Railway Supply Company,** Chicago, as reported in the *Railway Age* of June 29, was born in Milwaukee, Wis.,

**George D. Casgrain**

and was employed by the Griffin Wheel Company for 40 years. His activities have been devoted to sales matters in addition to which he has had supervision over all purchases since 1932. From 1890 to 1895, he was employed by the Fitzsimmons & Connell Company, contractors and timber dealers, and from 1895 to 1900, he worked in the contract department of the Chicago Telephone Company. In January of the latter year, Mr. Casgrain resigned to become associated with the Griffin Wheel Company.

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EXPERIMENTS WITH LIGNITE as a locomotive fuel are currently being carried on by the French National Railways with a view to exploitation of lignite deposits in Dschang, French Cameroons.

# Financial

BRIDGTON & HARRISON.—*Abandonment.* This company has asked the Interstate Commerce Commission for authority to abandon its line extending from Bridgton Junction, Me., to Bridgton, 15.9 miles.

CARLTON & COAST. — *Abandonment.* — This company has asked the Interstate Commerce Commission for authority to abandon its line extending from Carlton, Ore., to its terminus, 20.4 miles.

CHATTAHOOCHEE.—*Note.*—This company has been authorized by Division 4 of the Interstate Commerce Commission to issue a promissory note or notes for $330,000 to evidence a loan in that amount, the proceeds to be applied to the payment of a like amount of its consolidated mortgage six per cent bonds which will mature July 1, 1940.

CHICAGO & EASTERN ILLINOIS.—*Organization.*—At the first meeting of the board of directors of the newly organized Chicago & Eastern Illinois Railroad Company at Chicago on July 2, steps were taken to complete the organization of the company which was incorporated in Indianapolis on June 27 of this year and executive officers and members of the executive committee were elected. Executive officers elected are: Charles T. O'Neal, president; James B. Ford, vice-president; George A. Burget, secretary and treasurer; William A. Ragel, comptroller; W. M. Templeton, assistant secretary; J. C. Sties, assistant comptroller, and N. E. Helme, assistant treasurer. The executive committee appointed includes Kenneth D. Steere, Charles T. O'Neal, William D. Fowler, Barrett Wendell and J. W. Barriger, III. Members of the board of directors are Charles T. O'Neal, Kenneth D. Steere, Will H. Hays, Joseph B. Graham, Robert C. Graham, Roger C. Hyatt, Frank O. Wetts, J. W. Barriger, III, Robert L. Hoguet, Barrett Wendell, Eugene J. Conroy, William B. Fowler, and Austin S. Igleheart.

DELAWARE & HUDSON.—*Abandonment and Joint Operation.*—This company has asked the Interstate Commerce Commission for authority to abandon its Chateaugay & Lake Placid branch extending from Plumadore, N. Y., to Saranac Lake, 22.1 miles and to operate over a line of the New York Central between these same points.

DENVER & RIO GRANDE WESTERN.—*Equipment Trust Certificates.*—This company has asked the Interstate Commerce Commission for authority to assume liability for $1,522,299 of four per cent equipment trust certificates, maturing in 15 equal annual installments beginning September 1, 1941. The proceeds will be used as part payment for equipment costing $1,698,110 and consisting of 500 50-ton, 40½ ft. box cars.

DENVER & RIO GRANDE WESTERN.—*Reorganization plan.*—The Reconstruction Finance Corporation on July 1, asked the

District Court at Denver, Colo., to approve the Interstate Commerce Commission's plan for the reorganization of the railroad. The railroad asked that the plan be returned to the I. C. C. for modification to conform with a plan filed by the road in 1936.

DeQueen & Eastern. — *Stock.* — This company has asked the Interstate Commerce Commission for authority to issue 60,000 shares of common stock of a par value of $5 per share. The new stock will be exchanged for the same amount of old stock for the purpose of rectifying an omission which occurred several years ago.

Minneapolis & St. Louis.—*Reorganization Plan.*—The reorganization managers of this company have asked the Interstate Commerce Commission to approve a new plan of reorganization for this company which differs only slightly from the one which the commission turned down on April 15. Details of the original plan were given in the *Railway Age* for May 20, 1939, page 882; while the commission's decision was outlined in the issue of April 20, page 711.

Briefly, the first plan contemplated that the road, which has been in receivership since July, 1923, would be split into two separate operating companies linked by stock ownership. The purchase of the properties was to be financed by a $5,000,000 loan from the Reconstruction Finance Corporation, guaranteed by 25-year first mortgage bonds bearing interest at the rate of four per cent.

Under the revised plan the loan would be for $4,000,000 instead of $5,000,000; the first mortgage bonds would be reduced by $1,000,000 from $5,000,000 to $4,000,000; and the second mortgage bonds would be reduced from $3,091,000 to $2,081,500. The petition states that the revised plan, which has the approval of the R. F. C., is "designed to meet the requirements of the Interstate Commerce Act as interpreted by the commission".

New York, Chicago & St. Louis.—*Refunding of Notes.*—This company has asked the Interstate Commerce Commission to approve a plan whereby it would offer holders of its outstanding six per cent notes, due October 1, 1941, 20 per cent in cash and the balance in new six per cent debentures due June 1, 1950. To carry out the plan the company would issue $10,859,750 of the new six per cent debentures. to refund the $12,678,750 of notes now outstanding. The application states that some $400,000 will be saved by the refunding operation.

Pacific Electric.—*Abandonment.*—This company would be authorized (1) to abandon some 88.5 miles of suburban lines in Los Angeles, Orange, and Riverside counties, California, and (2) abandon operation, under trackage rights, over a line of the Union Pacific in Riverside and San Bernardino counties, Calif., 8.5 miles, if Division 4 of the Interstate Commerce Commission adopts a proposed report of its Examiner R. Romero.

Pennsylvania.—*Approval of Operating Agreement.*—This company has asked the Interstate Commerce Commission to approve a supplementary agreement between itself and the Long Island whereby the rental paid by it for operating over the Long Island in New York City would be reduced by approximately $1,000,000 a year.

St. Louis-San Francisco.—*Abandonment.*—This company would be authorized to abandon a portion of its so-called Bentonville branch extending from Bentonville, Ark., to Grove, Okla., 41 miles, if Division 4 of the Interstate Commerce Commission adopts a proposed report of its Examiner A. G. Nye.

Southern Pacific.—*Bonds of the Texas & New Orleans.*—Division 4 of the Interstate Commerce Commission has modified its order of May 14, 1938, so as to authorize (1) the Southern Pacific to sell to the Texas & New Orleans at par and accrued interest, the latter's first and refunding mortgage bonds, series A, in amounts sufficient to meet the sinking fund requirements of its first and refunding mortgage and (2) the Texas & New Orleans to deliver these bonds to the trustee under that mortgage.

Texas Electric.—*Abandonment.*—This company has asked the Interstate Commerce Commission for authority to abandon its Corsicana branch, extending from Dallas, Tex., to Corsicana, 51.8 miles.

Trenton-Princeton. — *Abandonment.*— The Trenton-Princeton Traction company would be permitted to abandon its entire line extending from Trenton, N. J., to Princeton, 12.6 miles, if the Interstate Commerce Commission adopts a recommended report of its Examiner R. Romero.

Western Maryland.—*Equipment Trust Certificates.*—This company has asked the Interstate Commerce Commission for authority to assume liability for $1,890,000 of two per cent equipment trust certificates, maturing in 10 equal annual installments of $189,000 each on July 15 in each of the years from 1941 to 1950, inclusive. The proceeds will represent 79.92 per cent of the purchase price of equipment costing $2,364,720 and consisting of 12 new standard gauge single expansion articulated 4-6-6-4 simple mallet steam locomotives. The issue has been sold at 98.775 to a group consisting of Salomon Brothers & Hutzler, Dick & Merle-Smith and Stround & Co.

## Average Prices of Stocks and Bonds

| | July 2 | Last week | Last year |
|---|---|---|---|
| Average price of 20 representative railway stocks.. | 27.48 | 26.83 | 27.74 |
| Average price of 20 representative railway bonds.. | 55.30 | 54.90 | 58 |

## Dividends Declared

Cleveland, Cincinnati, Chicago & St. Louis.—$5.00, semi-annually; Preferred, $1.25, quarterly, both payable July 31 to holders of record July 20.

Louisville, Henderson & St. Louis.—$4.00, semi-annually; Preferred, $2.50, semi-annually, both payable August 15 to holders of record August 1.

Philadelphia, Germantown & Norristown.—$1.50, payable September 4 to holders of record August 20.

Piedmont & Northern.—50¢, payable July 20 to holders of record July 5.

# Railway Officers

## EXECUTIVES

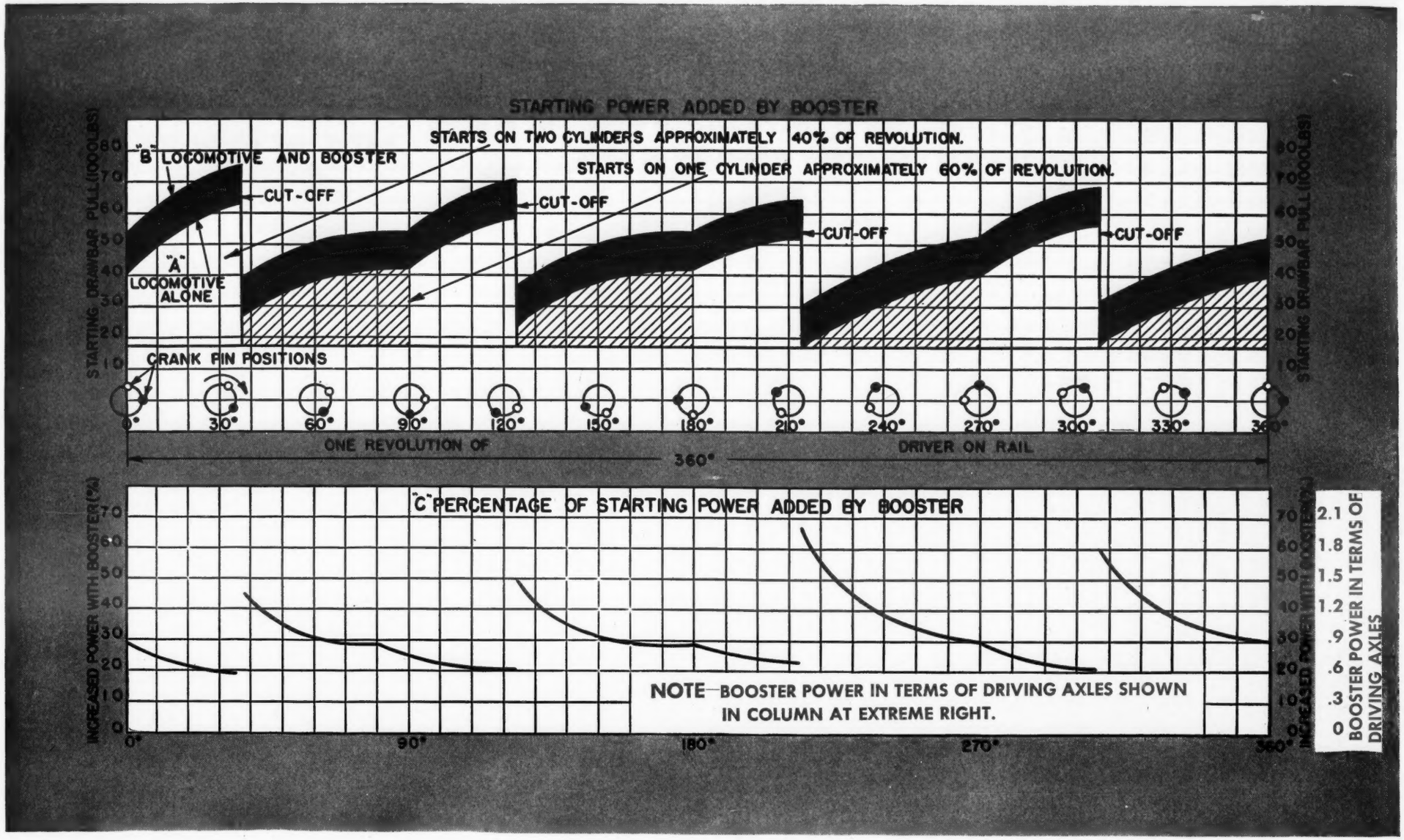
**F. L. Annable,** president and general manager of the San Diego & Arizona Eastern and of the Tijuana & Tecate, with headquarters at San Diego, Cal., has retired and the operation of the San Diego & Arizona Eastern has been taken over by the Los Angeles division of the Southern Pacific. Mr. Annable entered railway service in 1893, with the Atchison, Topeka & Santa Fe at San Bernardino, Cal., and in 1904, he went with the Los Angeles & Salt Lake (now part of the Union Pacific), as chief clerk to the superintendent. In 1910, he was appointed general superintendent of the Arizona & Swansea (operation since suspended) at Swansea, Ariz., and in 1911, he became assistant superintendent of the Pacific Electric at Los Angeles, Cal., later becoming division superintendent at Pomona, Cal., and general superintendent at Los Angeles. In July, 1929, he was appointed president and general manager of the San Diego & Arizona Eastern.

**George E. Graham,** vice-president and general manager of the Dominion Atlantic, with headquarters at Kentville, N. S., whose retirement was announced in the *Railway Age* of June 29, entered railroad service on July 4, 1888, as operator with the Canadian Pacific, serving in this capacity until 1900, when he became supervisor of weighing. In 1905, he was appointed superintendent of terminals at Winnipeg, Man., becoming assistant superintendent at Brandon, Man., in 1906, and superitendent at Brandon in 1907. Mr. Graham later

George E. Graham

served as superintendent at Ft. Williams, Ont., and Vancouver, B. C. On October 1, 1913, he was appointed general manager of the Coquitlam Terminal Company at Vancouver, which position he held until November 1, 1915, when he went with the Dominion Atlantic as general manager. Mr. Graham became vice-president and general manager on April 1, 1928. He is

*Continued on second left-hand page*


STARTING POWER ADDED BY BOOSTER
STARTS ON TWO CYLINDERS APPROXIMATELY 40% OF REVOLUTION.
STARTS ON ONE CYLINDER APPROXIMATELY 60% OF REVOLUTION.
"B" LOCOMOTIVE AND BOOSTER
"A" LOCOMOTIVE ALONE
CUT-OFF
CUT-OFF
CUT-OFF
CUT-OFF
STARTING DRAWBAR PULL (1000 LBS)
CRANK PIN POSITIONS
0° 30° 60° 90° 120° 150° 180° 210° 240° 270° 300° 330° 360°
ONE REVOLUTION OF DRIVER ON RAIL
360°
"C" PERCENTAGE OF STARTING POWER ADDED BY BOOSTER
INCREASED POWER WITH BOOSTER (%)
0° 90° 180° 270° 360°
NOTE—BOOSTER POWER IN TERMS OF DRIVING AXLES SHOWN IN COLUMN AT EXTREME RIGHT.
2.1 1.8 1.5 1.2 .9 .6 .3 0
BOOSTER POWER IN TERMS OF DRIVING AXLES

# STARTING POWER ADDED BY BOOSTER*

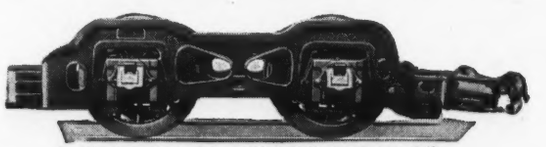
THE rated draw bar pull of a locomotive is the average of the constantly varying effort exerted throughout one revolution of the driving wheels. Such a rating considers that the locomotive is moving and is by no means a correct indication of the power exerted in starting from a state of rest.

Starting power depends entirely upon the exact position of the cranks at the instant of starting. Crank position not only controls the leverage between piston and driving wheel but also determines whether or not both valves are open for admission of steam to the cylinders.

The above chart illustrates a typical starting draw bar pull curve for a modern two-cylinder locomotive with Booster. Curve "A" shows the starting draw bar pull of the main locomotive for all crank positions. Curve "B" represents the combined starting draw bar pull of the locomotive and Booster, the shaded area between curves "A" and "B" being the starting draw bar pull added by the Booster. Curve "C" in the lower portion of the chart shows in percent the increased power with the Booster for all crank positions.

***The chart also clearly shows that for about 216° or 60.4% of the crank circle the power of only one cylinder is available for starting.*** This means that most starts would be made with one cylinder, or slack would have to be taken to place the cranks in a more favorable position, if Booster power is not used.

***It will also be observed that at four points on the crank circle the starting effort of the locomotive reaches a minimum at which approximately one-third of the rated draw bar pull is exerted. It is at these low points that Booster power is most effective, in some cases adding as much as 67% to the starting draw bar pull of the locomotive, or the equivalent of 2 additional driving axles.***



*Trademark Registered United States Patent Office

REG. U.S. PAT. OFF.

FRANKLIN RAILWAY SUPPLY COMPANY, INC.

NEW YORK CHICAGO MONTREAL

also vice-president for the Nova Scotia, Canadian Chamber of Commerce.

**George H. Pabst, Jr.,** assistant vice-president and treasurer of the Pennsylvania at Philadelphia, Pa. has been ap-

**George H. Pabst, Jr.**

pointed vice-president in charge of finance and corporate relations. Mr. Pabst was born in New York City in 1888 and attended the public schools of Philadelphia, completing his education at the Evening School of Accounts and Finance of the University of Pennsylvania. He has been in the service of the Pennsylvania continuously since 1906, starting as a clerk in the accounting department. Three years later he was transferred to the office of the second vice-president, and in 1917, became chief clerk to the special assistant to president. On July 1, 1925, Mr. Pabst was promoted to analyst in the treasury department, becoming assistant treasurer on December 1, 1926. He was elected treasurer on April 24, 1929, and in December, 1938, was promoted by action of the board of directors to assistant vice-president and treasurer, which position he held until his present appointment.

**Edward H. Holden,** whose promotion to assistant to the executive vice-president of the Kansas City Southern and the

**Edward H. Holden**

Louisiana & Arkansas, with headquarters at Kansas City, Mo., was announced in the *Railway Age* of June 22, was born at Atchison, Kan., on June 24, 1870, and entered railway service on June 1, 1886, as a clerk and telegraph operator for the Santa Fe at Scranton, Kan. Later he worked as a dispatcher, chief dispatcher and division superintendent for the Missouri Pacific. In January, 1906, he went with the Kansas City Southern as a trainmaster and later that year he went with the Denver & Rio Grande Western as an assistant superintendent at Salt Lake City, Utah. Mr. Holden returned to the K. C. S. in June, 1907, as a trainmaster, later being promoted to superintendent and on August 1, 1912, to general superintendent of transportation, the position he held until his recent promotion.

## FINANCIAL, LEGAL AND ACCOUNTING

**William E. Osborn,** assistant to comptroller of the New York Central, with headquarters at New York, has retired, after 47 years of railroad service.

**S. V. Reeves,** assistant statistician of the Atchison, Topeka & Santa Fe, with headquarters at Chicago, has been promoted to statistician, with the same headquarters, a **change in title.**

**Wilbur G. Hunt,** assistant general auditor of the Eastern lines of the Atchison, Topeka & Santa Fe, with headquarters at Topeka, Kan., has been promoted to assistant general auditor of the system, with headquarters at Chicago, succeeding **Walter E. Davis,** whose election to general auditor was announced in the *Railway Age* of May 4. **C. O. Clark,** auditor of disbursements of the Eastern lines, has been appointed auditor. Eastern lines, with headquarters as before at Topeka, Kan., succeeding to the duties of Mr. Hunt. **E. S. Marsh,** chief clerk to the auditor of disbursements at Topeka, has been promoted to auditor of disbursements at that point, relieving Mr. Clark.

**A. R. Seder,** assistant comptroller of the Chicago & North Western, has been appointed general auditor, with headquarters as before at Chicago, succeeding **Charles D. Brandriff,** who has retired. Mr. Brandriff was born at Millville, N. J., on February 18, 1874, and graduated from the University of Michigan in 1897. He entered railway service in November, 1897, as a clerk in the storekeeper's office at Missouri Valley, Iowa. Two years later he was transferred to the general storekeeper's office at Chicago, and in March, 1900, he was appointed assistant general bookkeeper in the office of the vice-president, accounting, later being promoted to general bookkeeper. Mr. Brandriff was advanced to general auditor on May 1, 1910, the position held until his retirement.

**Howard W. Schotter,** assistant treasurer of the Pennsylvania, has been appointed treasurer, with headquarters as before at Philadelphia, and **Frederick E. Godfrey,** assistant to the treasurer, has been appointed assistant treasurer, with headquarters at Philadelphia. Mr. Schotter was born and educated in Philadelphia. After several years in the investment banking business in Philadelphia, he entered railroad service in November, 1906, as a clerk in the executive department of the Pennsylvania. In December, 1917, he was assigned to duty in the president's office and in 1919 was appointed chief clerk to the president. In July, 1925, he was pro-

**Howard W. Schotter**

moted to analyst in the treasury department and a year later became assistant treasurer. Mr. Schotter is the author of "The Growth and Development of the Pennsylvania Railroad Company", published some years ago.

**Sidney F. Blanc,** whose promotion to general attorney on the Chicago, Burlington & Quincy, with headquarters at Chicago, was announced in the *Railway Age* of June 22, was born at Chicago on November 19, 1885, and entered railway service on June 16, 1902. In 1907, he gradu-

**Sidney F. Blanc**

ated from the Kent College of Law, Chicago, and in 1915, he was promoted to attorney. Mr. Blanc was appointed attorney for the Eastern district, with headquarters at Chicago on July 1, 1938, and held that position until his recent promotion, which was effective June 4.

## OPERATING

**J. J. Daley,** superintendent of the Syracuse division of the New York Central, with headquarters at Syracuse, N. Y., has been transferred to the Ohio Central division, with headquarters at Columbus, Ohio, relieving **K. A. Borntrager,** whose transfer to the Rochester division, with head-

*Continued on next left-hand page*

NO. 122 OF A SERIES OF FAMOUS ARCHES OF THE WORLD

## SERNADA BRIDGE

**PORTUGAL**

This viaduct of the Portugese Railways was built in 1911 and is typical of the masonry construction erected in Portugal prior to 1914. The bridge is located in the Vale of Vouga and is a single track structure carrying a heavy passenger and freight service. The total length is 572 ft. and the height is 42 ft. The seven equal spans each measure 65 ft. » » » The Security Sectional Arch for the locomotive firebox was designed and developed to further the economy and effectiveness of the steam locomotive. To realize the utmost from your power, be sure that every locomotive that leaves your roundhouse is equipped with a complete arch.

**HARBISON-WALKER REFRACTORIES CO.**

***Refractory Specialists***

**AMERICAN ARCH CO.**
**INCORPORATED**
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***Locomotive Combustion Specialists***

quarters at Rochester, N. Y., was announced in the *Railway Age* of June 29.

**W. D. Lamprecht,** assistant trainmaster on the Southern Pacific at Carlin, Nev., has been promoted to trainmaster at Dunsmuir, Cal., succeeding **H. W. Hall,** who has been transferred to Watsonville Jct., Cal.

**Aberto Garduno,** road foreman of engines of the National Railways of Mexico, has been promoted to assistant general manager to succeed **Ramon P. Garza,** who has been relieved of duties in compliance with a ruling of the convention of the Workers Administration on the grounds of serious "administration errors."

## TRAFFIC

**H. M. Johnson,** freight traffic manager on the Missouri Pacific, has been promoted to general freight traffic manager, a newly created position, with headquarters as before at St. Louis, Mo. **C. D. Bordelon,** assistant freight traffic manager, with headquarters at St. Louis, has been promoted to freight traffic manager in charge of rates and divisions, with the same headquarters, succeeding **Claud H. Guion,** whose death on June 9, was announced in

**H. M. Johnson**

the *Railway Age* of June 15. **T. B. Duggan,** assistant general freight agent at St. Louis, has been advanced to general freight agent, with the same headquarters, and **A. G. Thaman** has been appointed assistant general freight agent, with headquarters at St. Louis.

Mr. Johnson was born at East St. Louis, Ill., on May 22, 1894, and prior to entering railway service in 1917, served for several years with the Southern Freight Association at St. Louis, in various capacities from tariff clerk to chief clerk. He entered railway service with the Missouri Pacific as a clerk in the freight traffic department and in 1920, he was advanced to chief clerk to the foreign freight agent, being further promoted to traveling foreign freight agent at St. Louis in May, 1923. Later he was made assistant foreign freight agent and in March, 1929, he was promoted to foreign freight agent. In June of the following year Mr. Johnson was further advanced to general freight agent at Kansas City, returning to St. Louis in November, 1932, as assistant freight traffic manager. Four years later he was advanced to freight traffic manager.

Mr. Bordelon entered the service of the

**C. D. Bordelon**

Missouri Pacific lines in April, 1928, as commercial agent for the Gulf Coast Lines at Houston, Tex. In October of the same year he was advanced to assistant general freight agent, with the same headquarters. In July, 1932, Mr. Bordelon was transferred to St. Louis, where he remained until November, 1936, when he was promoted to assistant freight traffic manager, rates.

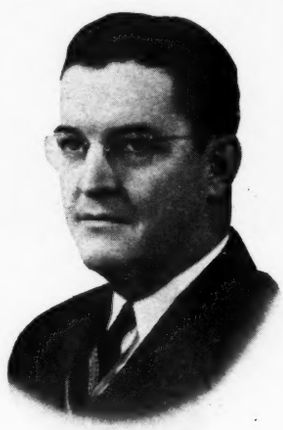
**John E. Capps,** assistant general freight agent on the Chicago, Rock Island & Pacific at Chicago, has been promoted to general freight agent, with the same headquarters, succeeding **Ephriam Rigg,** whose resignation to accept appointment as a member of the standing rate committee of the Western Trunk Line Committee was announced in the *Railway Age* of June 1. **Leonard Hill,** chief clerk in the freight office at Kansas City, Mo., has been promoted to assistant general freight agent at Chicago, relieving **E. A. Tharp,** who has been assigned to succeed Mr. Capps. **L. S. Harris,** rate clerk at Ft. Worth, Tex., has been promoted to assistant general freight agent at that point,

**John E. Capps**

succeeding **A. L. Talkington,** whose promotion to general freight agent, with headquarters at Ft. Worth, was announced in the *Railway Age* of June 1. **Ira D. Brown,** traveling freight and passenger agent at Wichita Falls, Tex., has been promoted to general agent at that point, a newly created position.

Mr. Capps, was born in Denver, Colo., on April 14, 1889, and entered railway service on the Rock Island at Chicago on June 1, 1913. A short time later he was appointed a rate clerk and subsequently served as clerk to the freight traffic manager, clerk to the assistant general freight agent and chief rate clerk, all at Chicago. On December 1, 1921, he was promoted to assistant chief clerk in the general freight department and on June 16, 1923, he was advanced to chief clerk of that department. Mr. Capps was further promoted to chief clerk to the vice-president and freight traffic manager on February 1, 1924, and on February 1, 1935, he was appointed assistant general freight agent at Chicago, the position he held until his promotion on July 1.

**James E. Payne,** whose promotion to assistant to the general traffic manager of the St. Louis-San Francisco, with headquarters at St. Louis, Mo., was announced in the *Railway Age* of June 8, was born at St. Louis on March 6, 1900, and entered railway service on June 16, 1916, in the



**James E. Payne**

freight accounting department of the Frisco at St. Louis. On August 1, 1920, he was promoted to city passenger agent and on February 1, 1928, he was advanced to assistant general passenger agent at Tulsa, Okla. Mr. Payne was further promoted to traffic manager, with headquarters at Tulsa, on February 1, 1933, and held that position until his recent promotion, which was effective July 1.

**William Charles Clark,** whose promotion to passenger traffic manager of the Kansas City Southern and the Louisiana & Arkansas, with headquarters at Shreveport, La., was announced in the *Railway Age* of June 22, was born near Monroe, La., on December 1, 1890, and entered railway service on April 10, 1918, at Texarkana, Ark., for the Missouri Pacific and Texas & Pacific (joint agency). On April 24, 1922, he went with the Louisiana & Arkansas at Texarkana as a rate clerk, later being promoted to chief rate clerk, chief clerk and chief clerk to the vice-president. Mr. Clark was appointed spe-

*Continued on next left-hand page*

# *He took along a Specialist*
# TO GET RESULTS

**To obtain results he acted on the advice of his guide . . . a specialist. His guide knew, through years and years of experience, just what to do and what not to do to get results.**

**To obtain maximum results from locomotives it is also wise to act on the advice of superheater specialists as to the type and size of superheater that would most effectively fulfill the operating requirements of the locomotives. Thirty years of experience in designing, manufacturing and observing the performance of locomotive superheaters the world over, has qualified us as superheater specialists. This experience qualifies us to prescribe the *right* superheater for the operating conditions of your locomotives. Use this service, it is free for the asking.**

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Montreal, Canada
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cial assistant to the vice-president at Shreveport on July 1, 1928, assistant traffic manager, with the same headquarters, on July 15, 1930, and assistant general

William Charles Clark

freight agent for the Kansas City Southern and the L. & A. at Kansas City, Mo., on December 1, 1939, holding the latter position until his recent promotion, which was effective June 16.

**L. A. Binkley,** general eastern passenger agent of the Louisville & Nashville at New York, has been appointed assistant general passenger agent, with headquarters at Louisville, Ky.

**J. B. Dorrance, Jr.,** district passenger agent of the Pennsylvania at Philadelphia, Pa., has been promoted to division passenger agent, with headquarters at Cleveland, Ohio, succeeding **H. A. Weiss,** whose promotion to division passenger agent at Pittsburgh, Pa. was announced in the *Railway Age* of May 18, page 877.

## MECHANICAL

**Walter Bohnstengel,** assistant engineer of tests on the Atchison, Topeka & Santa Fe, has been promoted to engineer of tests for the system, with headquarters as before at Topeka, Kan., succeeding to a portion of the duties of **E. E. Chapman,** mechanical assistant at Chicago, who has been serving also as engineer of tests.

**Gerald P. Trachta,** superintendent of motive power on the Chicago, Rock Island & Pacific, with headquarters at Chicago, has been promoted to assistant chief operating officer-mechanical, a newly created position, with the same headquarters and with jurisdiction over the mechanical department and all matters pertaining thereto. **A. R. Ruiter,** assistant to the chief operating officer, with headquarters at Chicago, has been appointed superintendent of motive power of the First Mechanical district, with the same headquarters, succeeding Mr. Trachta.

Mr. Trachta was born at Schuyler, Neb., on October 5, 1883, and entered railway service on December 19, 1901, as a roundhouse sweeper on the Chicago, Burlington & Quincy at Sheridan, Wyo., later being advanced to machinist helper and machinist. He entered engine service on March 10, 1903, as a locomotive fireman, being advanced to locomotive engineer on October 5, 1905, and to road foreman of engines on the Sheridan division on October 1, 1910. Seven years later he was further promoted to master mechanic on the Casper division, resigning on December 1, 1919, to accept a position as road foreman of engines on the Arizona Eastern (now part of the Southern Pacific), at Phoenix, Ariz. On March 1, 1923, Mr. Trachta returned to the Burlington as enginehouse foreman at Wymore, Neb., being promoted to general foreman at Kansas City, Mo., on August 1, 1923, and to master mechanic at Omaha, Neb., on August 1, 1925. Subsequently he was transferred to Galesburg, Ill., and thence to St. Joseph, Mo. On March 1, 1937, he was appointed district

Gerald P. Trachta

superintendent of motive power on the Chicago, Rock Island & Pacific, with headquarters at Kansas City, Mo., and in the latter part of 1938, he was transferred to Chicago.

## ENGINEERING AND SIGNALING

**R. H. Meintel,** assistant division engineer of the Ft. Wayne division of the Pennsylvania, has been promoted to division engineer of the Eastern division, succeeding **J. L. Cranwell,** whose promotion to superintendent of the Monongahela division was announced in the *Railway Age* of June 22, page 1143.

**H. A. Appleby,** assistant signal engineer on the Western lines of the Atchison, Topeka & Santa Fe, with headquarters at Amarillo, Tex., has been transferred to Topeka, Kan., succeeding **J. A. Parkinson,** whose promotion to signal engineer of the Western lines and of the Panhandle & Santa Fe, with headquarters at Amarillo, was announced in the *Railway Age* of June 29. **V. O. Smeltzer,** chief draftsman in the office of the system signal engineer, with headquarters at Topeka, has been advanced to assistant signal engineer at Amarillo, relieving Mr. Appleby.

## OBITUARY

**Thomas C. Peck,** who retired on November 1, 1926, as general passenger agent of the Los Angeles & Salt Lake (now part of the Union Pacific) with headquarters at Los Angeles, Cal., died at his home in Arcadia, Cal., on June 29. Mr. Peck was born at Indianapolis, Ind., on October 14, 1856, and completed a course in architecture and engineering in the office of Edwin May, the architect of the Indiana State capitol. In 1878, he entered railway service in the engineering corps of the Jeffersonville, Madison & Indianapolis (now a part of the Pennsylvania) and in December, 1880, he became a freight clerk on the Cleveland, Columbus, Cincinnati & Indianapolis (now a part of the New York Central) at Indianapolis. From March, 1884, to August, 1886, he acted as city ticket agent for the same railroad and until October, 1888, he was district passenger agent. He was then appointed general traveling agent and general passenger agent of the Ft. Wayne, Cincinnati & Louisville (now a part of the New York, Chicago & St. Louis) and in June, 1890, he became chief clerk in the general passenger department of the Columbus, Hocking Valley & Toledo (now part of the Chesapeake & Ohio). From November, 1896, to April, 1901, he served successively as general agent, general passenger agent and assistant general manager of the Los Angeles Terminal. He was then appointed assistant general passenger agent on the San Pedro, Los Angeles & Salt Lake. In May, 1907, he was promoted to general passenger agent on that road and its successor, the Los Angeles & Salt Lake, a position he held until his retirement.

**Ralph Modjeski,** prominent bridge designing and construction engineer of Chicago, died on June 26. During his lifetime, Mr. Modjeski had designed and supervised the construction of many large railroad bridges throughout the United States and Canada.

**John L. Erdall,** general counsel of the Minneapolis, St. Paul & Sault Ste. Marie, with headquarters at Minneapolis, Minn., died suddenly at Rochester, Minn., on June 30. Mr. Erdall was born in Dane County, Wis., and graduated from the University

John L. Erdall

of Wisconsin Law School. He entered railway service in 1901 as assistant general attorney of the Chicago Great Western. In March, 1908, he went with the Minneapolis, St. Paul & Sault Ste. Marie as general attorney, and was later promoted to general solicitor. In December, 1938, he was advanced to general counsel.

## REVENUES AND EXPENSES OF RAILWAYS

MONTH OF MAY AND FIVE MONTHS OF CALENDAR YEAR 1940

| Name of road | | Av. mileage operated during period | Operating revenues: Freight | Passenger | Total (inc. misc.) | Operating expenses: Maintenance of Way and structures | Maintenance of Equipment | Traffic | Transportation | Total | Operating ratio | Net from railway operation | Operating income | Net railway operating income 1940 | Net railway operating income 1939 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Akron, Canton & Youngstown | May | 171 | $176,578 | $20 | $185,535 | $23,323 | $24,288 | $13,470 | $55,784 | $126,190 | 68.0 | $59,345 | $44,170 | $32,735 | $8,647 |
| | 5 mos. | 171 | 889,656 | 145 | 928,824 | 115,533 | 106,288 | 69,074 | 285,254 | 622,370 | 67.0 | 306,454 | 231,354 | 170,502 | 65,140 |
| Alton | May | 959 | 864,541 | 190,033 | 1,241,485 | 257,825 | 217,901 | 48,488 | 533,703 | 1,128,107 | 90.9 | 113,378 | 52,633 | —110,125 | —33,073 |
| | 5 mos. | 959 | 4,310,847 | 1,037,831 | 6,303,177 | 870,658 | 1,136,363 | 228,940 | 2,743,699 | 5,335,336 | 84.6 | 967,841 | 508,863 | —298,997 | —159,093 |
| Atchison, Topeka & Santa Fe System | May | 13,414 | 10,498,651 | 1,390,986 | 13,073,473 | 2,490,056 | 3,069,473 | 497,669 | 4,792,714 | 11,218,167 | 85.8 | 1,855,306 | 600,728 | 631,637 | 106,055 |
| | 5 mos. | 13,417 | 48,687,872 | 6,719,884 | 61,204,942 | 9,820,124 | 14,931,732 | 2,336,842 | 23,294,898 | 52,239,566 | 85.4 | 8,965,376 | 2,853,085 | 2,846,736 | 328,579 |
| Atlanta & West Point | May | 93 | 102,991 | 21,345 | 146,665 | 21,610 | 30,227 | 9,122 | 64,985 | 135,907 | 92.7 | 10,758 | —1,048 | —11,381 | —6,906 |
| | 5 mos. | 93 | 540,329 | 117,062 | 769,885 | 112,406 | 137,003 | 43,011 | 327,421 | 673,234 | 87.4 | 96,651 | 38,254 | —21,945 | —36,378 |
| Western of Alabama | May | 133 | 108,957 | 21,118 | 147,193 | 20,748 | 33,001 | 8,588 | 57,820 | 129,001 | 87.6 | 18,192 | 5,454 | 9,474 | 3,439 |
| | 5 mos. | 133 | 525,259 | 114,695 | 725,424 | 105,896 | 154,227 | 40,964 | 289,394 | 637,742 | 87.9 | 87,682 | 24,885 | 33,802 | 36,114 |
| Atlanta, Birmingham & Coast | May | 639 | 258,804 | 5,262 | 287,009 | 47,057 | 54,106 | 24,467 | 117,206 | 260,311 | 90.7 | 26,698 | —74 | —24,038 | —30,482 |
| | 5 mos. | 639 | 1,190,981 | 172,861 | 1,476,530 | 249,682 | 256,696 | 119,985 | 624,843 | 1,340,872 | 90.8 | 135,658 | 5,749 | —111,106 | —13,090 |
| Atlantic Coast Line | May | 5,101 | 2,927,865 | 457,831 | 3,824,340 | 438,378 | 941,738 | 156,535 | 1,650,642 | 3,348,931 | 87.6 | 475,409 | 25,409 | —193,767 | 277,277 |
| | 5 mos. | 5,102 | 15,732,205 | 4,772,501 | 22,868,400 | 2,266,050 | 4,416,760 | 827,069 | 9,023,933 | 17,673,242 | 77.3 | 5,195,158 | 2,595,158 | 1,349,274 | 2,772,227 |
| Charleston & Western Carolina | May | 343 | 225,830 | 1,272 | 231,506 | 28,420 | 40,247 | 9,760 | 70,456 | 155,241 | 67.1 | 76,265 | 54,265 | 47,459 | 38,591 |
| | 5 mos. | 343 | 1,106,636 | 6,722 | 1,135,922 | 136,380 | 228,986 | 45,426 | 367,159 | 806,325 | 71.0 | 329,597 | 212,597 | 186,080 | 183,469 |
| Baltimore & Ohio | May | 6,380 | 13,008,331 | 820,305 | 14,753,077 | 1,304,452 | 2,984,003 | 428,404 | 5,036,520 | 10,496,687 | 71.2 | 4,256,390 | 3,300,642 | 2,958,943 | 876,626 |
| | 5 mos. | 6,382 | 59,951,140 | 3,813,687 | 67,864,993 | 5,944,132 | 15,561,479 | 2,021,893 | 25,303,237 | 51,968,403 | 76.6 | 15,896,590 | 11,128,674 | 9,535,548 | 5,844,338 |
| Staten Island Rapid Transit | May | 24 | 59,277 | 68,468 | 135,413 | 13,732 | 24,709 | 1,154 | 75,893 | 127,412 | 94.1 | 8,001 | —17,201 | —24,110 | —24,554 |
| | 5 mos. | 24 | 289,834 | 326,723 | 652,671 | 51,189 | 121,216 | 5,699 | 388,892 | 624,318 | 95.7 | 28,353 | —102,708 | —133,262 | —148,544 |
| Bangor & Aroostook | May | 603 | 435,062 | 11,234 | 465,800 | 94,126 | 82,042 | 4,894 | 119,566 | 324,339 | 69.6 | 141,461 | 94,856 | 105,782 | 116,080 |
| | 5 mos. | 603 | 2,626,732 | 75,735 | 2,794,257 | 439,205 | 436,745 | 24,351 | 688,424 | 1,712,041 | 61.3 | 1,082,216 | 798,545 | 769,824 | 837,172 |
| Bessemer & Lake Erie | May | 224 | 1,873,596 | 957 | 1,881,180 | 154,713 | 321,484 | 12,302 | 235,686 | 756,668 | 40.2 | 1,124,512 | 885,415 | 916,995 | 122,538 |
| | 5 mos. | 224 | 4,576,649 | 3,323 | 4,620,496 | 530,002 | 1,507,068 | 62,863 | 928,394 | 3,188,788 | 69.0 | 1,431,708 | 961,754 | 1,203,971 | —213,336 |
| Boston & Maine | May | 1,910 | 2,843,093 | 469,630 | 3,803,673 | 493,293 | 585,234 | 66,601 | 1,482,318 | 2,788,587 | 73.3 | 1,015,086 | 725,896 | 509,455 | 409,691 |
| | 5 mos. | 1,910 | 13,943,109 | 2,739,232 | 19,107,102 | 2,461,829 | 2,954,940 | 314,543 | 7,794,033 | 14,306,004 | 74.9 | 4,801,098 | 3,310,250 | 2,193,903 | 1,963,417 |
| Burlington, Rock Island | May | 255 | 73,783 | 19,494 | 101,913 | 15,448 | 17,635 | 4,088 | 47,036 | 93,453 | 91.7 | 8,460 | —2,600 | —8,910 | —30,101 |
| | 5 mos. | 255 | 393,498 | 89,056 | 522,632 | 81,187 | 91,377 | 22,022 | 251,750 | 494,292 | 94.6 | 28,340 | —23,465 | —55,612 | —92,265 |
| Cambria & Indiana | May | 37 | 108,420 | ..... | 108,516 | 14,208 | 61,200 | 402 | 11,266 | 92,304 | 85.06 | 16,212 | —4,712 | 54,422 | 22,925 |
| | 5 mos. | 37 | 629,879 | ..... | 630,351 | 37,831 | 244,876 | 2,245 | 65,883 | 380,702 | 60.40 | 249,649 | 95,268 | 434,224 | 318,139 |
| Canadian Pacific Lines in Maine | May | 234 | 192,303 | 12,132 | 216,984 | 60,680 | 41,087 | 6,115 | 65,481 | 178,641 | 82.3 | 38,343 | 27,380 | 13,081 | —66,074 |
| | 5 mos. | 234 | 1,500,268 | 60,518 | 1,622,885 | 166,644 | 252,208 | 35,702 | 503,450 | 986,385 | 60.8 | 636,500 | 579,254 | 463,727 | 204,909 |
| Canadian Pacific Lines in Vermont | May | 91 | 77,051 | 5,426 | 95,009 | 20,138 | 25,887 | 2,219 | 66,087 | 117,014 | 123.2 | —22,005 | —29,619 | —49,933 | —45,733 |
| | 5 mos. | 91 | 414,651 | 40,098 | 507,666 | 67,929 | 128,625 | 13,005 | 337,702 | 562,186 | 110.7 | —54,520 | —90,892 | —191,581 | —251,277 |
| Central of Georgia | May | 1,871 | 1,119,666 | 93,544 | 1,363,233 | 187,333 | 282,521 | 56,048 | 584,364 | 1,186,504 | 87.0 | 176,729 | 51,816 | 36,070 | 57,276 |
| | 5 mos. | 1,871 | 5,370,626 | 549,401 | 6,719,273 | 925,407 | 1,354,817 | 273,368 | 2,978,579 | 5,926,080 | 88.2 | 793,193 | 175,539 | 74,756 | 151,054 |
| Central of New Jersey | May | 710 | 2,335,129 | 322,063 | 2,837,866 | 296,978 | 624,333 | 48,696 | 1,151,669 | 2,224,616 | 78.4 | 613,250 | 191,757 | 68,664 | 65,865 |
| | 5 mos. | 710 | 11,860,109 | 1,630,540 | 14,391,707 | 1,192,081 | 3,145,585 | 235,008 | 5,979,336 | 11,026,168 | 76.6 | 3,365,539 | 1,307,209 | 414,799 | 201,956 |
| Central Vermont | May | 422 | 507,638 | 19,560 | 563,895 | 72,574 | 72,503 | 12,336 | 221,003 | 397,680 | 70.5 | 166,215 | 141,876 | 100,740 | 43,241 |
| | 5 mos. | 422 | 2,341,082 | 138,225 | 2,662,687 | 321,700 | 442,762 | 58,463 | 1,133,176 | 2,051,224 | 77.0 | 611,463 | 492,181 | 302,147 | —7,028 |
| Chesapeake & Ohio | May | 3,115 | 11,277,021 | 296,710 | 12,090,641 | 1,043,894 | 2,128,084 | 206,194 | 2,676,835 | 6,347,703 | 52.5 | 5,742,938 | 4,226,890 | 4,146,141 | 812,996 |
| | 5 mos. | 3,116 | 50,561,938 | 1,262,428 | 53,636,671 | 5,079,254 | 10,398,800 | 1,025,402 | 12,866,569 | 30,901,878 | 57.6 | 22,734,793 | 16,116,365 | 16,448,793 | 7,063,446 |
| Chicago & Eastern Illinois | May | 924 | 910,493 | 108,044 | 1,189,904 | 170,936 | 226,873 | 57,018 | 498,821 | 1,013,957 | 85.2 | 175,947 | 85,947 | —45,998 | —47,121 |
| | 5 mos. | 924 | 4,877,073 | 629,151 | 6,272,025 | 747,042 | 1,194,072 | 283,187 | 2,626,682 | 5,168,527 | 82.4 | 1,103,498 | 675,498 | 32,520 | 32,312 |
| Chicago & Illinois Midland | May | 131 | 325,162 | 566 | 350,275 | 46,391 | 57,867 | 19,903 | 84,326 | 228,428 | 65.2 | 121,847 | 85,855 | 88,133 | 46,058 |
| | 5 mos. | 131 | 1,698,096 | 3,177 | 1,792,225 | 218,199 | 334,774 | 103,185 | 458,637 | 1,213,145 | 67.7 | 579,080 | 410,881 | 395,477 | 300,950 |
| Chicago & North Western | May | 8,327 | 5,697,107 | 869,016 | 7,331,415 | 1,159,616 | 1,451,232 | 197,561 | 2,829,063 | 5,961,324 | 81.3 | 1,370,091 | 790,391 | 673,568 | —311,724 |
| | 5 mos. | 8,327 | 25,528,246 | 4,146,845 | 33,520,330 | 4,935,072 | 7,324,927 | 922,200 | 14,644,016 | 29,423,137 | 87.8 | 4,097,193 | 1,111,988 | —72,292 | —1,932,227 |
| Chicago, Burlington & Quincy | May | 8,958 | 5,545,505 | 628,388 | 7,016,464 | 1,678,052 | 1,297,125 | 278,524 | 2,757,939 | 6,314,051 | 90.0 | 702,413 | —67,880 | —345,436 | 378,183 |
| | 5 mos. | 8,994 | 29,628,492 | 3,127,900 | 36,877,299 | 4,959,634 | 7,047,990 | 1,258,869 | 14,481,900 | 29,224,348 | 79.2 | 7,652,951 | 3,838,810 | 2,291,619 | 2,319,395 |
| Chicago Great Western | May | 1,502 | 1,309,117 | 29,439 | 1,438,500 | 185,309 | 239,355 | 57,581 | 548,676 | 1,078,861 | 75.0 | 359,639 | 264,265 | 83,306 | 99,090 |
| | 5 mos. | 1,502 | 6,491,469 | 178,215 | 7,182,342 | 952,264 | 1,225,892 | 296,552 | 2,825,953 | 5,557,048 | 77.4 | 1,625,294 | 1,150,275 | 246,755 | 243,050 |
| Chicago, Indianapolis & Louisville | May | 549 | 693,937 | 41,296 | 810,600 | 71,847 | 110,868 | 28,708 | 280,141 | 527,418 | 65.1 | 283,182 | 242,376 | 151,127 | —4,165 |
| | 5 mos. | 549 | 3,355,102 | 200,886 | 3,902,400 | 338,216 | 647,120 | 142,864 | 1,465,427 | 2,770,834 | 71.0 | 1,131,566 | 919,483 | 439,912 | —290,898 |

Continued on second left-hand page

# Minimizes

# EMC D

ELECTRO-MOTIVE

*SUBSIDIARY OF GENERAL MOTORS*

# Switching Costs

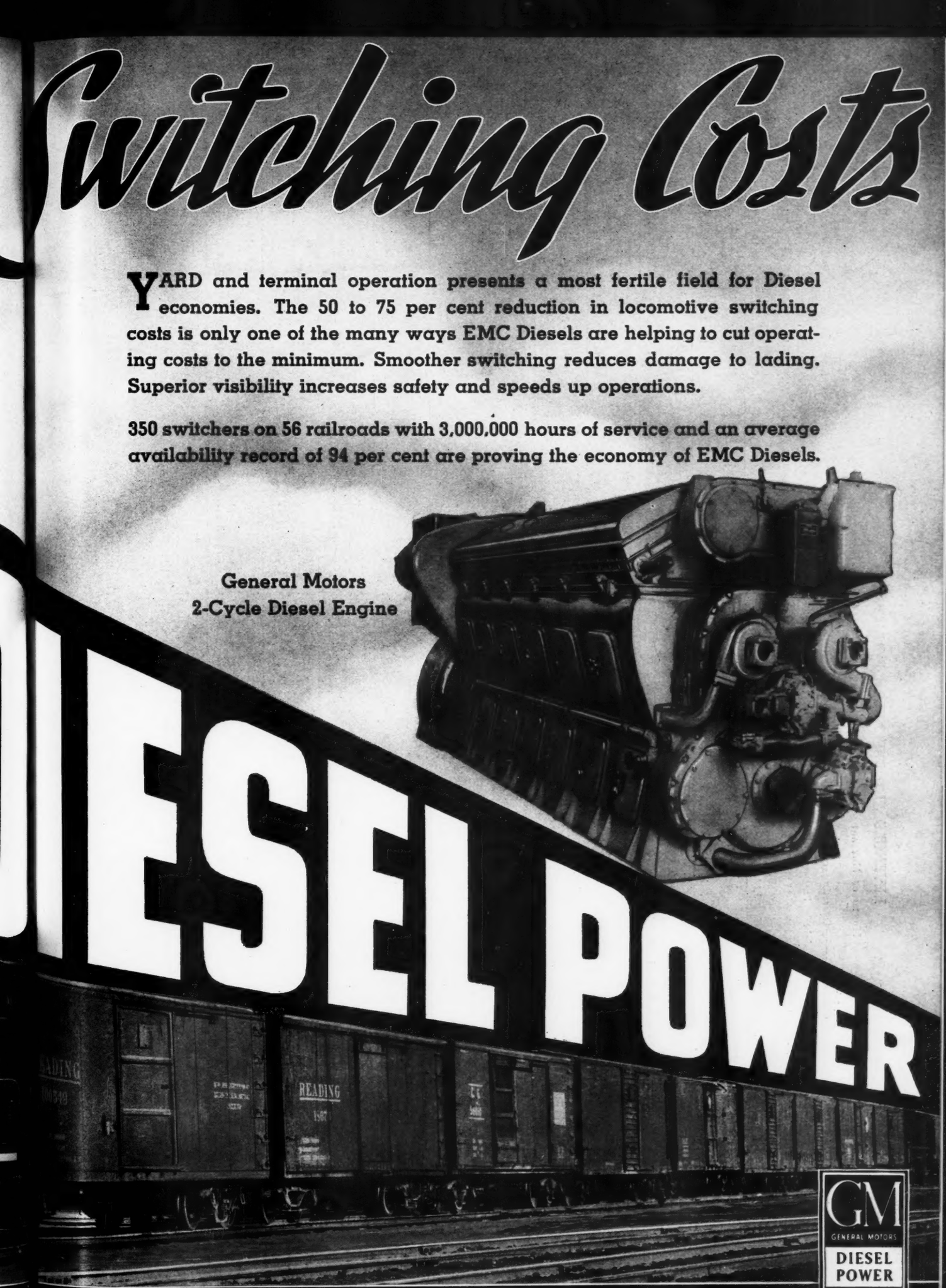
YARD and terminal operation presents a most fertile field for Diesel economies. The 50 to 75 per cent reduction in locomotive switching costs is only one of the many ways EMC Diesels are helping to cut operating costs to the minimum. Smoother switching reduces damage to lading. Superior visibility increases safety and speeds up operations.

350 switchers on 56 railroads with 3,000,000 hours of service and an average availability record of 94 per cent are proving the economy of EMC Diesels.



General Motors
2-Cycle Diesel Engine

# DIESEL POWER




GM
GENERAL MOTORS
DIESEL POWER

CORPORATION
LA GRANGE, ILLINOIS, U. S. A.

# REVENUES AND EXPENSES OF RAILWAYS

MONTH OF MAY AND FIVE MONTHS OF CALENDAR YEAR 1940—CONTINUED

| Name of road | | Av. mileage operated during period | Operating revenues: Freight | Passenger | Total (inc. misc.) | Operating expenses: Maintenance of Way and structures | Maintenance of Equipment | Traffic | Transportation | Total | Operating ratio | Net from railway operation | Operating income | Net railway operating income 1940 | 1939 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Chicago, Milwaukee, St. Paul & Pacific | May | 10,882 | $7,414,235 | $528,029 | $8,958,868 | $2,308,857 | $1,717,504 | $247,031 | $3,261,887 | $7,882,627 | 88.0 | $1,076,241 | $337,241 | —$136,441 | —$193,288 |
| | 5 mos. | 10,883 | 36,358,374 | 2,813,644 | 43,379,555 | 6,353,793 | 8,490,691 | 1,125,334 | 16,857,442 | 34,673,188 | 79.9 | 8,706,367 | 5,190,367 | 3,178,002 | 599,157 |
| Chicago, Rock Island & Pacific | May | 7,909 | 5,095,317 | 571,569 | 6,267,052 | 1,006,684 | 1,166,039 | 263,876 | 2,415,404 | 5,118,717 | 81.7 | 1,148,335 | 661,915 | 286,039 | 89,543 |
| | 5 mos. | 7,884 | 24,808,245 | 3,146,388 | 30,847,444 | 3,844,230 | 6,061,987 | 1,289,564 | 12,450,635 | 25,240,092 | 81.8 | 5,607,352 | 3,169,156 | 1,184,420 | 379,593 |
| Chicago, St. Paul, Minneapolis & Omaha | May | 1,629 | 1,156,017 | 106,323 | 1,359,384 | 233,423 | 240,832 | 41,561 | 619,546 | 1,199,541 | 88.2 | 159,843 | 47,788 | —70,506 | —105,253 |
| | 5 mos. | 1,629 | 5,601,761 | 578,042 | 6,632,376 | 831,017 | 1,269,625 | 196,694 | 3,283,637 | 5,919,428 | 89.3 | 712,948 | 145,654 | —411,289 | —545,216 |
| Clinchfield Railroad | May | 308 | 700,792 | 3,538 | 710,366 | 53,422 | 119,781 | 21,345 | 136,455 | 346,321 | 48.8 | 364,045 | 272,581 | 288,782 | 183,572 |
| | 5 mos. | 308 | 3,770,025 | 16,924 | 3,815,293 | 206,895 | 591,093 | 97,549 | 695,326 | 1,669,522 | 43.8 | 2,145,771 | 1,689,452 | 1,762,538 | 1,173,123 |
| Colorado & Southern | May | 786 | 439,789 | 27,562 | 512,593 | 71,700 | 120,281 | 13,549 | 199,868 | 431,651 | 84.2 | 80,942 | 82,623 | 68,996 | 24,405 |
| | 5 mos. | 786 | 2,161,903 | 135,689 | 2,542,166 | 287,384 | 505,725 | 70,425 | 1,052,259 | 2,050,511 | 80.7 | 491,655 | 184,386 | 101,318 | —19,077 |
| Forth Worth & Denver City | May | 902 | 423,519 | 41,786 | 467,239 | 66,335 | 84,296 | 18,284 | 173,992 | 371,636 | 79.5 | 95,603 | 57,767 | 23,625 | 1,318 |
| | 5 mos. | 902 | 2,098,059 | 216,666 | 2,287,740 | 286,039 | 411,714 | 93,270 | 842,066 | 1,782,325 | 77.9 | 505,415 | 316,765 | 164,330 | 18,303 |
| Columbus & Greenville | May | 168 | 81,726 | 3,837 | 91,085 | 15,477 | 19,259 | 4,493 | 35,584 | 85,423 | 93.8 | 5,662 | —853 | 543 | 19,498 |
| | 5 mos. | 168 | 446,310 | 23,789 | 499,395 | 78,872 | 74,601 | 21,822 | 182,962 | 413,661 | 82.8 | 85,734 | 23,241 | 24,906 | 85,140 |
| Delaware & Hudson | May | 846 | 2,067,014 | 53,348 | 2,203,602 | 272,069 | 397,470 | 43,056 | 774,668 | 1,568,368 | 71.2 | 635,233 | 480,097 | 453,887 | 432,804 |
| | 5 mos. | 846 | 9,794,063 | 383,512 | 10,608,265 | 1,171,678 | 1,990,706 | 210,526 | 3,973,912 | 7,767,845 | 73.2 | 2,840,419 | 2,069,582 | 1,948,152 | 2,036,184 |
| Delaware, Lackawanna & Western | May | 995 | 3,309,027 | 509,640 | 4,279,180 | 325,776 | 775,159 | 116,282 | 1,876,023 | 3,253,550 | 76.0 | 1,025,630 | 576,430 | 569,560 | 637,193 |
| | 5 mos. | 995 | 16,790,488 | 2,585,064 | 21,521,195 | 1,363,419 | 4,185,072 | 555,533 | 9,935,617 | 16,811,596 | 78.1 | 4,709,599 | 2,512,299 | 2,220,184 | 2,140,305 |
| Denver & Rio Grande Western | May | 2,554 | 1,699,913 | 84,013 | 1,901,647 | 338,722 | 494,377 | 88,577 | 701,423 | 1,695,538 | 89.2 | 206,109 | —8,673 | —61,799 | —215,665 |
| | 5 mos. | 2,554 | 8,391,311 | 475,146 | 9,361,432 | 1,377,059 | 2,502,920 | 381,746 | 3,517,361 | 8,185,263 | 87.4 | 1,176,169 | 118,000 | —145,574 | —397,587 |
| Denver & Salt Lake | May | 232 | 124,475 | 4,261 | 137,947 | 29,252 | 39,760 | 2,555 | 47,672 | 129,099 | 93.6 | 8,848 | —15,839 | 36,970 | —15,964 |
| | 5 mos. | 232 | 867,653 | 29,563 | 941,602 | 103,321 | 219,795 | 13,604 | 300,527 | 686,902 | 72.9 | 254,700 | 129,562 | 360,445 | 195,062 |
| Detroit & Mackinac | May | 242 | 55,404 | 1,455 | 64,126 | 13,483 | 10,824 | 894 | 22,763 | 50,970 | 79.5 | 13,156 | 8,041 | 4,555 | 3,430 |
| | 5 mos. | 242 | 227,446 | 10,124 | 270,903 | 46,153 | 57,331 | 4,380 | 116,568 | 240,688 | 88.8 | 30,215 | 12,207 | —1,569 | 2,823 |
| Detroit & Toledo Shore Line | May | 50 | 264,960 | ..... | 265,898 | 35,979 | 23,899 | 8,601 | 74,909 | 151,082 | 56.8 | 114,816 | 88,564 | 42,090 | —30,175 |
| | 5 mos. | 50 | 1,681,272 | ..... | 1,687,786 | 129,731 | 119,570 | 43,332 | 432,171 | 762,639 | 45.2 | 925,147 | 713,098 | 431,663 | 182,221 |
| Detroit, Toledo & Ironton | May | 472 | 525,892 | 179 | 540,137 | 62,349 | 89,793 | 12,536 | 134,172 | 319,151 | 59.1 | 220,986 | 157,378 | 143,692 | 105,167 |
| | 5 mos. | 472 | 3,403,059 | 852 | 3,486,760 | 344,181 | 439,243 | 61,169 | 768,475 | 1,714,339 | 49.2 | 1,772,421 | 1,343,843 | 1,219,879 | 833,207 |
| Duluth, Missabe & Iron Range | May | 541 | 2,716,582 | 1,276 | 3,184,312 | 240,279 | 243,458 | 4,560 | 449,839 | 969,632 | 30.5 | 2,214,680 | 1,636,291 | 1,641,145 | 758,109 |
| | 5 mos. | 541 | 3,390,241 | 7,077 | 3,976,392 | 717,039 | 1,115,512 | 21,719 | 1,115,434 | 3,124,265 | 78.6 | 852,127 | —359,771 | —355,348 | —1,426,953 |
| Duluth, Winnipeg & Pacific | May | 175 | 117,657 | 842 | 121,573 | 26,667 | 20,620 | 2,170 | 46,651 | 99,432 | 81.8 | 22,141 | 12,304 | 702 | —18,782 |
| | 5 mos. | 175 | 569,344 | 4,890 | 589,191 | 108,465 | 104,931 | 10,622 | 238,567 | 479,152 | 81.3 | 110,039 | 62,642 | —18,427 | —56,546 |
| Elgin, Joliet & Eastern | May | 390 | 1,169,738 | 6 | 1,459,498 | 136,344 | 275,944 | 15,075 | 569,512 | 1,030,735 | 70.6 | 428,763 | 316,687 | 266,140 | —24,145 |
| | 5 mos. | 390 | 6,756,679 | 71 | 7,873,184 | 644,243 | 1,490,982 | 73,671 | 3,094,402 | 5,478,954 | 69.6 | 2,394,230 | 1,781,536 | 1,347,240 | 863,022 |
| Erie | May | 2,268 | 5,778,706 | 365,196 | 6,640,686 | 641,605 | 1,199,920 | 187,552 | 2,542,935 | 4,837,873 | 72.9 | 1,802,813 | 1,233,047 | 986,759 | 559,272 |
| | 5 mos. | 2,268 | 28,834,803 | 1,816,469 | 32,858,472 | 2,719,151 | 6,607,979 | 885,624 | 13,035,032 | 24,581,974 | 74.8 | 8,276,498 | 5,428,446 | 3,989,718 | 3,382,417 |
| Florida East Coast | May | 685 | 710,203 | 144,892 | 946,277 | 133,835 | 164,507 | 27,865 | 300,763 | 683,656 | 72.2 | 262,621 | 190,355 | 116,400 | —7,843 |
| | 5 mos. | 685 | 3,129,209 | 2,091,541 | 5,828,176 | 559,651 | 798,155 | 153,074 | 1,916,312 | 3,826,398 | 65.7 | 2,001,778 | 1,627,176 | 1,303,566 | 1,284,902 |
| Georgia Railroad | May | 329 | 294,868 | 10,362 | 331,113 | 43,185 | 61,731 | 18,477 | 140,021 | 277,789 | 83.9 | 53,324 | 38,042 | 42,596 | 35,846 |
| | 5 mos. | 329 | 1,401,632 | 61,269 | 1,583,492 | 189,584 | 272,431 | 90,400 | 701,230 | 1,322,760 | 83.5 | 260,732 | 186,205 | 216,396 | 206,007 |
| Georgia & Florida | May | 408 | 82,605 | 1,344 | 87,685 | 21,821 | 17,267 | 8,715 | 36,645 | 89,804 | 102.4 | —2,119 | —10,410 | —13,968 | —6,497 |
| | 5 mos. | 408 | 422,158 | 6,001 | 445,956 | 112,188 | 81,218 | 42,998 | 187,072 | 450,071 | 100.9 | —4,115 | —45,383 | —65,433 | —65,005 |
| Grand Trunk Western | May | 1,029 | 1,814,459 | 69,395 | 2,010,457 | 261,843 | 367,746 | 42,373 | 778,909 | 1,524,887 | 75.8 | 485,570 | 356,716 | 268,244 | 54,807 |
| | 5 mos. | 1,029 | 9,404,791 | 343,963 | 10,423,898 | 1,226,576 | 1,953,012 | 203,389 | 4,083,320 | 7,819,094 | 75.0 | 2,604,804 | 1,969,574 | 1,529,914 | 385,656 |
| Canadian National Lines in New England | May | 172 | 147,789 | 1,714 | 170,629 | 48,156 | 21,520 | 1,544 | 58,844 | 135,816 | 79.6 | 34,813 | 18,718 | —12,213 | —84,557 |
| | 5 mos. | 172 | 621,150 | 15,354 | 709,753 | 176,656 | 141,495 | 7,413 | 341,081 | 701,992 | 98.9 | 7,761 | —72,713 | —279,458 | —305,004 |
| Great Northern | May | 8,069 | 8,089,735 | 282,736 | 9,119,723 | 1,258,743 | 1,391,657 | 212,082 | 2,357,670 | 5,435,162 | 59.6 | 3,684,561 | 2,772,969 | 2,603,113 | 1,512,813 |
| | 5 mos. | 8,069 | 28,460,083 | 1,384,242 | 32,489,257 | 4,093,496 | 6,415,016 | 996,244 | 11,156,131 | 23,831,473 | 73.4 | 8,657,784 | 4,967,206 | 4,316,715 | 1,577,091 |
| Green Bay & Western | May | 234 | 127,071 | 234 | 131,898 | 29,966 | 14,348 | 6,762 | 46,007 | 102,245 | 77.5 | 29,653 | 15,121 | 13,999 | 23,270 |
| | 5 mos. | 234 | 664,528 | 1,336 | 690,116 | 118,245 | 79,646 | 34,595 | 240,489 | 498,077 | 72.1 | 192,039 | 121,414 | 101,135 | 100,705 |
| Gulf & Ship Island | May | 259 | 88,935 | 2,540 | 100,940 | 24,360 | 17,487 | 2,417 | 47,566 | 96,530 | 95.6 | 4,410 | —11,594 | —20,969 | —14,530 |
| | 5 mos. | 259 | 454,032 | 17,481 | 522,035 | 106,930 | 77,871 | 13,112 | 255,492 | 474,846 | 91.0 | 47,189 | —32,978 | —75,855 | —83,254 |
| Gulf, Mobile & Northern | May | 827 | 532,881 | 16,062 | 572,660 | 82,445 | 87,167 | 42,760 | 157,753 | 406,704 | 71.0 | 165,956 | 115,956 | 77,957 | 100,625 |
| | 5 mos. | 827 | 2,638,312 | 78,701 | 2,836,880 | 379,397 | 440,774 | 202,231 | 775,605 | 1,976,797 | 69.7 | 860,083 | 610,083 | 417,734 | 433,574 |

# REVENUES AND EXPENSES OF RAILWAYS

MONTH OF MAY AND FIVE MONTHS OF CALENDAR YEAR 1940—CONTINUED

| Name of road | | Av. mileage operated during period | Operating revenues: Freight | Passenger | Total (inc. misc.) | Operating expenses: Maintenance of Way and structures | Maintenance of Equipment | Traffic | Transportation | Total | Operating ratio | Net from railway operation | Operating income | Net railway operating income 1940 | Net railway operating income 1939 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Illinois Central | May | 4,949 | $6,247,177 | $619,457 | $7,593,403 | $921,088 | $1,925,561 | $191,576 | $2,973,630 | $6,349,873 | 83.6 | $1,243,530 | $539,804 | $374,254 | $633,952 |
| | 5 mos. | 4,949 | 33,262,511 | 3,709,010 | 40,228,407 | 4,126,834 | 9,026,851 | 1,032,428 | 15,727,321 | 31,614,816 | 78.6 | 8,613,591 | 5,005,160 | 4,554,039 | 4,590,520 |
| Yazoo & Mississippi Valley | May | 1,608 | 1,222,528 | 64,483 | 1,364,113 | 137,075 | 207,439 | 29,694 | 477,662 | 897,748 | 65.8 | 466,365 | 325,773 | 249,546 | 188,486 |
| | 5 mos. | 1,610 | 5,498,301 | 268,389 | 6,149,774 | 588,531 | 932,076 | 160,884 | 2,466,555 | 4,378,851 | 71.2 | 1,770,923 | 1,069,055 | 707,337 | 515,087 |
| Illinois Central System | May | 6,557 | 7,469,705 | 683,940 | 8,957,516 | 1,058,163 | 2,133,000 | 221,270 | 3,451,292 | 7,247,621 | 80.9 | 1,709,895 | 863,604 | 633,713 | 831,352 |
| | 5 mos. | 6,559 | 38,760,812 | 3,977,399 | 46,378,181 | 4,715,365 | 9,958,927 | 1,193,312 | 18,193,876 | 35,993,667 | 77.6 | 10,384,514 | 6,064,357 | 5,304,941 | 5,152,672 |
| Illinois Terminal | May | 477 | 391,394 | 60,061 | 496,705 | 57,198 | 71,574 | 16,618 | 164,741 | 330,345 | 66.51 | 166,360 | 115,718 | 96,156 | 98,847 |
| | 5 mos. | 479 | 1,916,325 | 302,659 | 2,419,766 | 254,378 | 362,551 | 85,066 | 852,400 | 1,646,014 | 68.02 | 773,752 | 541,666 | 431,400 | 368,754 |
| Kansas City Southern | May | 879 | 995,669 | 34,206 | 1,136,808 | 99,649 | 153,841 | 52,395 | 338,305 | 701,087 | 61.7 | 435,721 | 332,721 | 274,607 | 214,745 |
| | 5 mos. | 879 | 5,100,418 | 133,877 | 5,789,089 | 503,897 | 808,777 | 277,738 | 1,723,469 | 3,601,862 | 62.2 | 2,187,227 | 1,682,227 | 1,395,876 | 1,193,841 |
| Kansas, Oklahoma & Gulf | May | 328 | 177,167 | 356 | 180,390 | 16,056 | 12,531 | 8,694 | 40,074 | 87,271 | 48.4 | 93,119 | 75,795 | 56,703 | 81,279 |
| | 5 mos. | 328 | 920,540 | 1,690 | 936,863 | 62,687 | 62,124 | 43,512 | 206,009 | 421,925 | 45.0 | 514,938 | 421,190 | 338,527 | 365,491 |
| Lake Superior & Ishpeming | May | 156 | 356,120 | 33 | 433,088 | 39,869 | 23,978 | 579 | 54,718 | 125,163 | 28.9 | 307,925 | 271,421 | 271,196 | 90,694 |
| | 5 mos. | 156 | 525,916 | 239 | 624,066 | 109,361 | 137,637 | 2,882 | 144,155 | 424,362 | 68.0 | 199,704 | 50,361 | 55,125 | —154,324 |
| Lehigh & Hudson River | May | 96 | 143,633 | ..... | 144,200 | 14,225 | 23,531 | 3,546 | 45,101 | 92,463 | 64.1 | 51,737 | 35,927 | 23,679 | 12,990 |
| | 5 mos. | 96 | 662,692 | ..... | 666,958 | 53,352 | 113,373 | 17,894 | 227,938 | 444,544 | 66.7 | 222,414 | 145,547 | 91,103 | 82,812 |
| Lehigh & New England | May | 190 | 368,862 | ..... | 372,067 | 39,351 | 62,397 | 6,212 | 116,411 | 239,374 | 64.3 | 132,693 | 97,507 | 104,002 | 134,507 |
| | 5 mos. | 190 | 1,704,286 | ..... | 1,715,158 | 154,806 | 315,353 | 34,856 | 563,493 | 1,146,800 | 66.9 | 568,358 | 414,760 | 442,953 | 473,894 |
| Lehigh Valley | May | 1,277 | 3,454,457 | 155,035 | 3,863,695 | 241,930 | 681,463 | 108,333 | 1,600,824 | 2,755,034 | 71.3 | 1,108,661 | 797,669 | 636,262 | 677,291 |
| | 5 mos. | 1,281 | 17,162,826 | 779,215 | 19,125,851 | 1,198,505 | 3,377,552 | 537,212 | 8,355,740 | 14,079,539 | 73.6 | 5,046,312 | 3,491,424 | 2,297,175 | 2,959,344 |
| Louisiana & Arkansas | May | 846 | 671,232 | 8,633 | 706,948 | 163,521 | 87,301 | 27,097 | 173,247 | 474,639 | 67.1 | 232,309 | 177,636 | 139,029 | 103,599 |
| | 5 mos. | 846 | 3,159,730 | 36,328 | 3,328,209 | 529,747 | 468,737 | 146,951 | 913,093 | 2,183,570 | 65.6 | 1,144,639 | 876,189 | 650,351 | 488,440 |
| Louisville & Nashville | May | 4,871 | 7,379,134 | 431,665 | 8,305,620 | 868,210 | 1,910,859 | 180,886 | 2,701,956 | 5,921,679 | 71.3 | 2,383,941 | 1,509,535 | 1,630,801 | 853,375 |
| | 5 mos. | 4,871 | 34,675,612 | 2,550,000 | 39,752,345 | 4,236,751 | 9,725,295 | 916,644 | 13,757,328 | 30,024,299 | 75.5 | 9,728,046 | 6,033,414 | 6,391,391 | 4,413,867 |
| Maine Central | May | 991 | 828,744 | 60,733 | 986,348 | 159,136 | 172,311 | 11,209 | 348,054 | 723,288 | 73.3 | 263,060 | 188,735 | 187,693 | 139,487 |
| | 5 mos. | 991 | 4,497,375 | 314,377 | 5,250,066 | 744,705 | 951,224 | 51,880 | 1,872,117 | 3,786,464 | 72.1 | 1,463,602 | 1,075,199 | 865,660 | 775,725 |
| Midland Valley | May | 352 | 93,183 | 6 | 94,694 | 18,041 | 15,282 | 2,545 | 29,061 | 70,733 | 74.7 | 23,961 | 12,260 | 5,866 | 19,015 |
| | 5 mos. | 352 | 532,826 | 30 | 542,186 | 64,684 | 49,664 | 13,294 | 158,168 | 315,448 | 58.2 | 226,738 | 169,859 | 128,999 | 135,699 |
| Minneapolis & St. Louis | May | 1,512 | 687,972 | 4,898 | 728,805 | 164,520 | 123,281 | 49,629 | 257,489 | 630,987 | 86.6 | 97,818 | 49,832 | 17,095 | 64,929 |
| | 5 mos. | 1,512 | 3,337,906 | 25,887 | 3,530,975 | 506,853 | 650,879 | 252,076 | 1,344,956 | 2,944,600 | 83.4 | 586,375 | 360,346 | 176,220 | 158,220 |
| Minneapolis, St. Paul & Sault Ste. Marie | May | 4,283 | 2,399,019 | 60,220 | 2,652,567 | 522,770 | 414,384 | 63,924 | 953,120 | 2,041,279 | 77.0 | 611,288 | 475,107 | 383,020 | 130,544 |
| | 5 mos. | 4,284 | 9,830,776 | 292,220 | 10,922,706 | 1,634,640 | 2,049,323 | 320,216 | 4,704,227 | 9,131,853 | 83.6 | 1,790,853 | 958,533 | 491,132 | —663,666 |
| Duluth, South Shore & Atlantic | May | 550 | 206,298 | 5,681 | 233,637 | 35,322 | 34,873 | 6,893 | 84,654 | 167,980 | 71.9 | 65,657 | 51,097 | 46,087 | —1,182 |
| | 5 mos. | 550 | 756,322 | 32,970 | 858,901 | 144,019 | 166,085 | 33,347 | 378,088 | 754,566 | 87.9 | 104,335 | 35,865 | 22,275 | —157,585 |
| Spokane International | May | 152 | 63,371 | 611 | 70,021 | 23,269 | 8,047 | 2,501 | 22,902 | 60,509 | 86.4 | 9,512 | 3,969 | 484 | —6,560 |
| | 5 mos. | 152 | 265,713 | 3,237 | 301,862 | 76,088 | 36,731 | 11,469 | 107,855 | 248,105 | 82.2 | 53,757 | 27,852 | 11,904 | 21,445 |
| Mississippi Central | May | 150 | 55,575 | 1,521 | 59,520 | 20,656 | 10,040 | 7,268 | 19,146 | 61,453 | 103.2 | —1,933 | —6,742 | —11,034 | —10,745 |
| | 5 mos. | 150 | 307,572 | 9,293 | 328,471 | 81,376 | 51,903 | 35,443 | 101,958 | 293,835 | 89.5 | 34,636 | 11,564 | —10,827 | —30,002 |
| Missouri & Arkansas | May | 365 | 94,866 | 1,449 | 102,227 | 27,839 | 10,592 | 7,111 | 30,917 | 81,290 | 79.5 | 20,937 | 16,570 | 7,749 | 8,303 |
| | 5 mos. | 365 | 440,466 | 6,749 | 484,700 | 115,004 | 53,068 | 34,805 | 155,350 | 382,259 | 78.9 | 102,441 | 80,536 | 37,616 | 21,654 |
| Missouri-Illinois | May | 193 | 178,589 | 331 | 181,913 | 24,855 | 27,566 | 3,059 | 48,438 | 109,690 | 60.3 | 72,223 | 52,602 | 40,676 | 55,370 |
| | 5 mos. | 193 | 826,947 | 1,522 | 841,027 | 92,693 | 113,680 | 15,486 | 237,062 | 485,880 | 57.8 | 355,147 | 272,594 | 216,994 | 204,893 |
| Missouri-Kansas-Texas Lines | May | 3,293 | 1,795,633 | 146,015 | 2,166,833 | 297,699 | 382,980 | 106,340 | 885,213 | 1,791,595 | 82.7 | 375,238 | 213,102 | 29,416 | 4,668 |
| | 5 mos. | 3,294 | 8,881,758 | 783,198 | 10,769,842 | 1,369,967 | 1,827,868 | 528,912 | 4,436,732 | 8,786,914 | 81.6 | 1,982,928 | 1,182,040 | 281,178 | 49,169 |
| Missouri Pacific | May | 7,146 | 5,578,680 | 378,576 | 6,663,979 | 1,081,646 | 1,347,343 | 240,089 | 2,498,634 | 5,431,110 | 81.5 | 1,232,869 | 722,744 | 434,284 | 287,907 |
| | 5 mos. | 7,146 | 28,548,912 | 2,087,041 | 33,830,859 | 4,697,893 | 6,812,386 | 1,217,203 | 13,084,179 | 27,154,994 | 80.3 | 6,675,865 | 4,128,277 | 2,497,837 | 1,377,295 |
| Gulf Coast Lines | May | 1,759 | 1,009,842 | 31,265 | 1,109,177 | 209,280 | 177,441 | 44,895 | 387,719 | 873,609 | 78.76 | 235,568 | 156,280 | 86,511 | 237,470 |
| | 5 mos. | 1,759 | 6,479,481 | 172,520 | 6,981,803 | 1,037,364 | 946,522 | 227,172 | 2,025,646 | 4,498,346 | 64.43 | 2,483,457 | 2,083,367 | 1,519,187 | 1,938,088 |
| International Great Northern | May | 1,155 | 762,978 | 62,847 | 930,793 | 162,722 | 178,817 | 29,735 | 425,949 | 847,787 | 91.1 | 83,006 | 19,046 | —53,010 | —19,301 |
| | 5 mos. | 1,155 | 3,723,104 | 388,987 | 4,680,015 | 788,492 | 952,108 | 151,772 | 2,082,106 | 4,245,513 | 90.7 | 434,502 | 112,848 | —237,583 | —303,787 |
| Mobile & Ohio | May | 1,181 | 952,948 | 23,034 | 1,030,224 | 170,218 | 188,976 | 44,986 | 346,213 | 794,491 | 77.1 | 235,733 | 171,494 | 84,828 | 94,669 |
| | 5 mos. | 1,181 | 4,421,547 | 110,369 | 4,768,995 | 813,755 | 910,822 | 218,140 | 1,717,492 | 3,878,321 | 81.3 | 890,674 | 565,917 | 181,976 | 280,978 |
| Monongahela | May | 172 | 409,166 | 563 | 411,443 | 41,017 | 33,350 | 461 | 83,476 | 162,434 | 39.5 | 249,009 | 210,067 | 129,120 | 9,219 |
| | 5 mos. | 172 | 2,124,963 | 2,848 | 2,140,572 | 189,568 | 185,907 | 2,468 | 465,213 | 858,229 | 40.1 | 1,282,343 | 1,085,467 | 687,412 | 220,888 |

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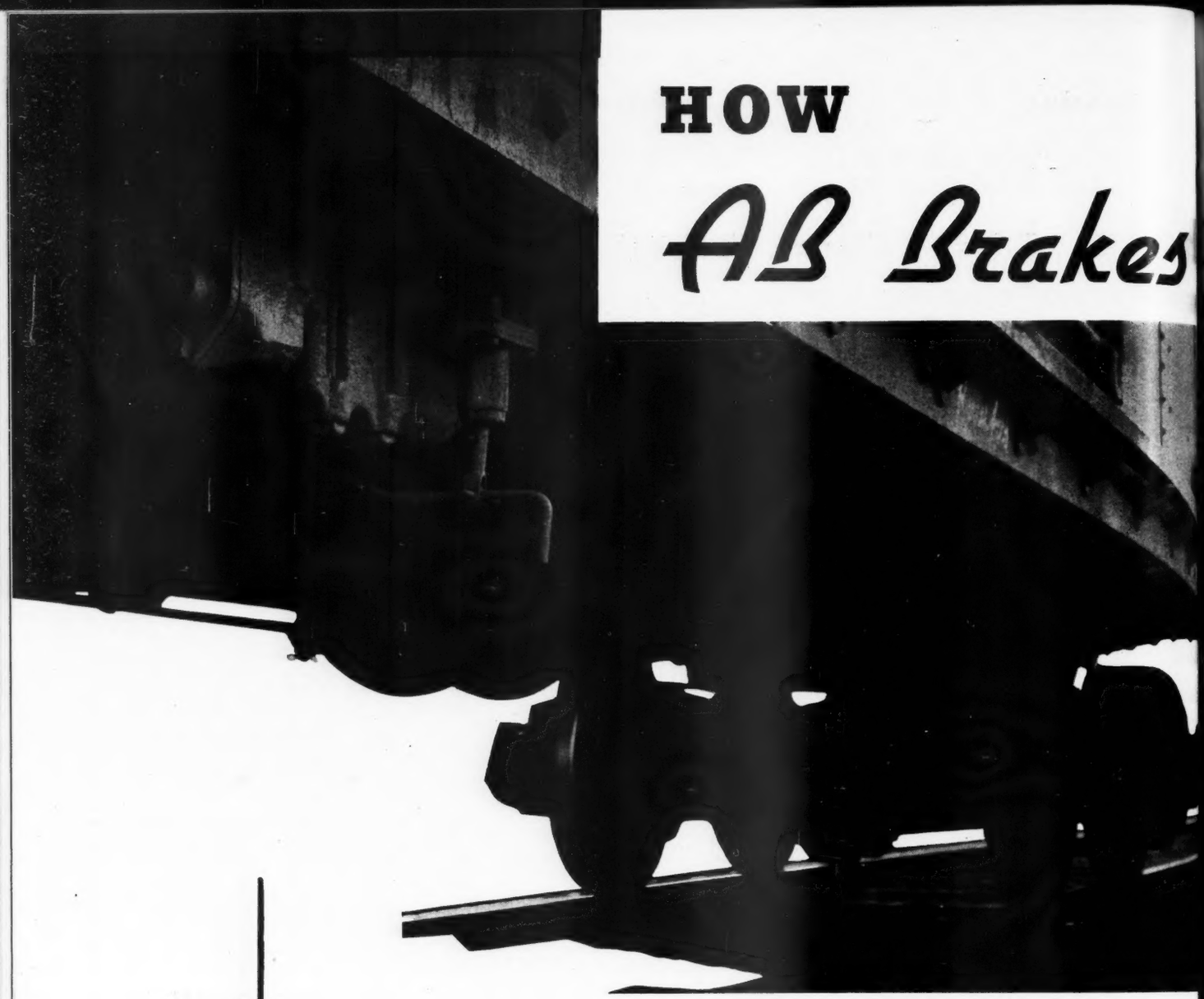


# HOW *AB Brakes*

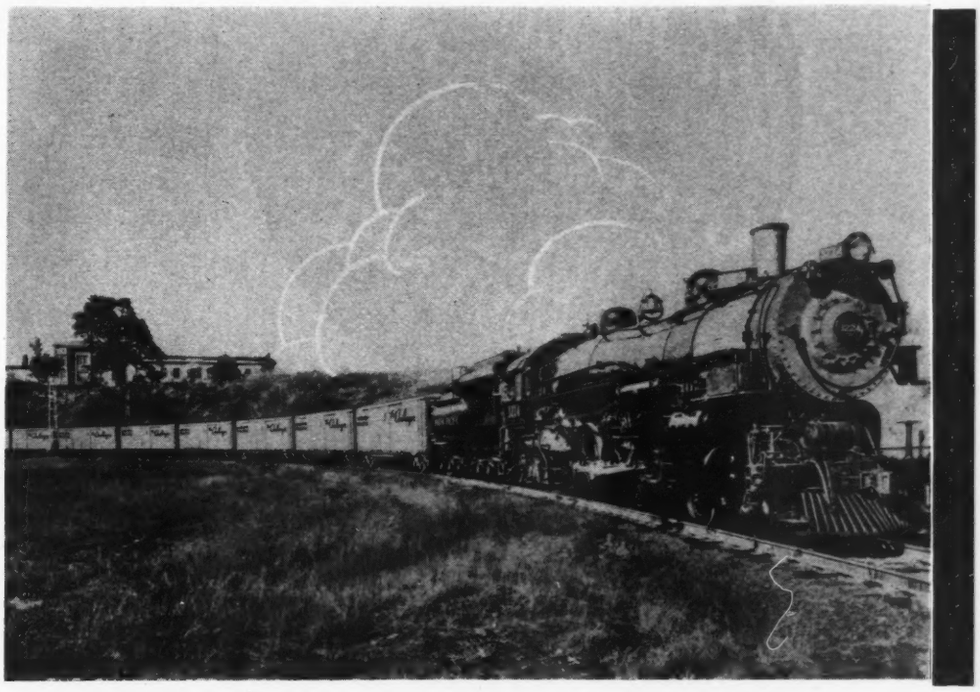
The Mechanical Department is concerned with the design and maintenance of equipment. It is responsible for securing maximum efficiency with minimum cost for up-keep . . . The AB Brake—having a high degree of structural and functional perfection—contributes toward lessening the efforts of this department. It is designed to assure long, trouble-free service of itself, and of other car equipment that it was evolved to safeguard in train operation.

**WESTINGHOUSE AIR**

# help the Mechanical Department

The AB Brake equipment embodies advanced means and methods to assure continued functional integrity — so vital to effective control of modern trains. Operating elements are designed to provide long life, extend time between cleaning periods, and to minimize replacements prior to scheduled major repairs. Unique protective devices exclude wear-producing grit. Re-enforced flanged unions and pipe anchorage prevent leakage and broken connections. Brake cylinder has a WABCO cup that needs no follower plate. Leakage is thereby reduced and replacement simplified. Means for continuous lubrication of the cylinder without dismantling is provided.

The AB Brake also assures time-and money-saving protection for other car elements by virtue of its certain and uniform functioning. All brakes apply with effective pressure quickly, and each car thus shares equally in train retardation. All brakes release quickly and surely. Therefore, brake shoes last longer, and wheel flats, burns, and thermal cracks are fewer . . . Positive, uniform action assures smooth control of train slack, with consequent protection against damage to car structure and appliances . . . Because of these several equipment safeguards, inspection delays are minimized, and a greater proportion of cars maintained available for continuous service.



To secure an uninterrupted service life from freight cars today, they must be equipped with the AB Brake. Its protective function is all the more needful now to meet the increasingly severe equipment requirements of intensive, high speed transportation when prompt, reliable deliveries are in such great demand by shippers.

# BRAKE COMPANY . . .

# HOLLOW FLEXIBLE STAYBOLTS

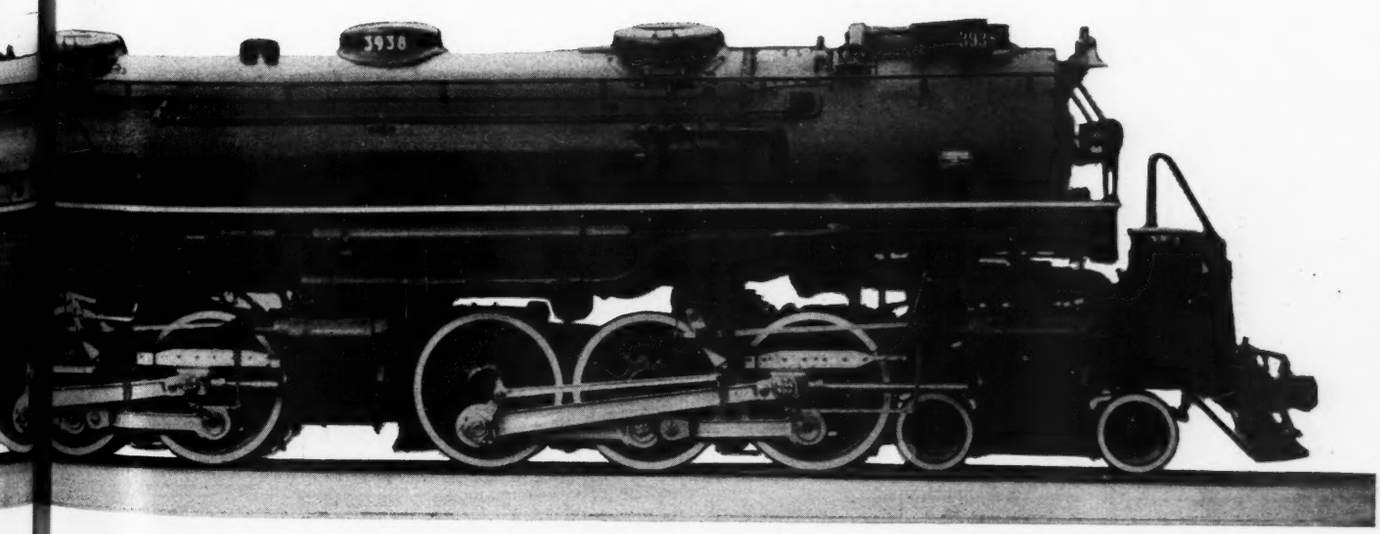
*Complete Installations Assure* **Greater Profits** *from* **FREIGHT REVENUES**

# *Keep the —*

## HIGH REVENUE Producers Producing-*And for a Lower Cost*

## FLANNERY BOLT COMPANY

BRIDGEVILLE PENNSYLVANIA



# REVENUES AND EXPENSES OF RAILWAYS

MONTH OF MAY AND FIVE MONTHS OF CALENDAR YEAR 1940—CONTINUED

| Name of road | | Av. mileage operated during period | Operating revenues | | | Operating expenses | | | | | Operating ratio | Net from railway operation | Operating income | Net railway operating income | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Maintenance of | | | | | | | | | |
| | | | Freight | Passenger | Total (inc. misc.) | Way and structures | Equipment | Traffic | Transportation | Total | | | | 1940 | 1939 |
| Montour | May | 51 | $200,289 | $..... | $201,473 | $22,557 | $44,621 | $656 | $42,555 | $116,572 | 57.9 | $84,901 | $55,652 | $77,786 | $14,914 |
| | 5 mos. | 51 | 808,902 | ..... | 817,243 | 59,137 | 208,878 | 4,520 | 217,849 | 521,808 | 63.8 | 295,435 | 194,011 | 327,784 | 166,680 |
| Nashville, Chattanooga & St. Louis | May | 1,111 | 1,033,934 | 67,147 | 1,229,353 | 135,266 | 247,278 | 66,120 | 484,748 | 988,008 | 80.4 | 241,345 | 160,702 | 136,837 | 149,062 |
| | 5 mos. | 1,111 | 5,021,015 | 508,033 | 6,206,174 | 628,570 | 1,225,843 | 339,198 | 2,505,364 | 4,982,302 | 80.3 | 1,223,872 | 824,958 | 678,775 | 826,536 |
| Nevada Northern | May | 165 | 59,795 | 1,112 | 65,566 | 7,702 | 2,685 | 1,222 | 9,697 | 25,864 | 39.4 | 39,702 | 27,202 | 29,635 | 17,866 |
| | 5 mos. | 165 | 274,718 | 4,196 | 301,226 | 37,636 | 12,799 | 6,171 | 50,886 | 132,149 | 43.9 | 169,077 | 111,348 | 121,743 | 87,063 |
| New York Central | May | 10,986 | 21,567,919 | 4,319,394 | 29,494,370 | 3,435,396 | 6,174,570 | 575,144 | 11,163,349 | 22,557,396 | 76.5 | 6,936,974 | 4,015,845 | 2,873,605 | 1,688,138 |
| | 5 mos. | 10,991 | 106,744,985 | 22,872,923 | 145,450,851 | 15,025,215 | 30,953,690 | 2,740,940 | 57,799,573 | 112,806,457 | 77.6 | 32,644,394 | 18,351,114 | 12,464,909 | 6,233,565 |
| Pittsburgh & Lake Erie | May | 233 | 1,760,474 | 36,049 | 1,853,045 | 156,340 | 524,745 | 27,990 | 527,815 | 1,317,718 | 71.1 | 535,327 | 319,417 | 524,434 | 109,962 |
| | 5 mos. | 233 | 8,012,665 | 204,689 | 8,482,468 | 713,827 | 3,354,661 | 141,677 | 2,762,372 | 7,363,672 | 86.8 | 1,118,796 | 230,772 | 1,415,179 | 410,308 |
| New York, Chicago & St. Louis | May | 1,704 | 3,288,988 | 46,692 | 3,449,064 | 405,534 | 593,445 | 123,613 | 1,320,903 | 2,567,667 | 74.5 | 881,397 | 649,284 | 383,332 | 431,457 |
| | 5 mos. | 1,704 | 17,615,904 | 277,742 | 18,436,838 | 1,824,733 | 3,088,251 | 613,899 | 6,859,070 | 12,988,772 | 70.5 | 5,448,066 | 4,272,796 | 2,743,078 | 2,297,917 |
| New York, New Haven & Hartford | May | 1,863 | 4,034,740 | 1,905,643 | 6,647,839 | 897,380 | 1,141,420 | 158,432 | 2,587,741 | 5,158,511 | 77.6 | 1,489,328 | 939,328 | 351,626 | 440,744 |
| | 5 mos. | 1,867 | 19,602,126 | 10,220,299 | 33,273,434 | 3,972,586 | 5,701,490 | 586,039 | 13,245,215 | 25,429,607 | 76.4 | 7,843,827 | 5,078,827 | 2,067,223 | 2,539,526 |
| New York Connecting | May | 21 | 183,173 | ..... | 197,858 | 40,054 | 8,991 | ..... | 29,011 | 79,387 | 40.1 | 118,471 | 74,593 | 73,486 | 54,728 |
| | 5 mos. | 21 | 964,692 | ..... | 1,017,788 | 146,072 | 33,237 | ..... | 147,299 | 333,546 | 32.8 | 684,242 | 468,092 | 498,389 | 580,773 |
| New York, Ontario & Western | May | 576 | 397,122 | 8,015 | 450,748 | 51,754 | 122,160 | 22,141 | 229,210 | 443,227 | 98.3 | 7,521 | —40,291 | —77,377 | —31,662 |
| | 5 mos. | 576 | 1,853,909 | 27,113 | 2,096,476 | 258,644 | 524,283 | 85,262 | 1,193,259 | 2,159,598 | 103.0 | —63,122 | —299,984 | —447,455 | —45,221 |
| New York, Susquehanna & Western | May | 144 | 219,139 | 17,416 | 248,029 | 24,312 | 31,298 | 2,274 | 103,501 | 173,049 | 69.8 | 74,980 | 44,898 | 19,085 | 34,830 |
| | 5 mos. | 144 | 1,152,445 | 91,718 | 1,302,261 | 89,936 | 133,235 | 9,693 | 531,325 | 822,221 | 63.1 | 480,040 | 328,163 | 199,411 | 144,794 |
| Norfolk & Western | May | 2,191 | 8,543,412 | 135,800 | 8,903,092 | 916,103 | 1,726,983 | 154,922 | 1,808,829 | 4,789,876 | 53.8 | 4,113,216 | 2,773,197 | 3,011,739 | 729,742 |
| | 5 mos. | 2,191 | 39,819,784 | 744,548 | 41,710,695 | 4,214,460 | 8,511,617 | 726,745 | 9,115,350 | 23,514,756 | 56.4 | 18,195,939 | 12,121,548 | 13,447,094 | 6,897,494 |
| Norfolk Southern | May | 805 | 322,633 | 2,534 | 338,583 | 71,059 | 52,236 | 25,537 | 135,758 | 307,186 | 90.7 | 31,397 | —1,683 | —20,929 | —22,334 |
| | 5 mos. | 805 | 1,590,354 | 13,618 | 1,678,036 | 358,880 | 268,596 | 125,037 | 674,276 | 1,532,181 | 91.3 | 145,855 | —18,840 | —101,976 | —45,400 |
| Northern Pacific | May | 6,720 | 5,049,179 | 265,450 | 5,758,142 | 775,804 | 1,151,161 | 198,815 | 1,887,211 | 4,266,512 | 74.1 | 1,491,630 | 900,243 | 168,082 | 590,991 |
| | 5 mos. | 6,720 | 21,796,454 | 1,254,548 | 25,126,328 | 3,357,688 | 5,335,262 | 833,528 | 9,354,400 | 20,199,198 | 80.4 | 4,927,130 | 2,109,897 | 3,593,287 | 1,027,826 |
| Northwestern Pacific | May | 352 | 196,103 | 45,420 | 265,486 | 67,166 | 49,382 | 2,577 | 147,042 | 276,238 | 104.0 | —10,752 | —30,394 | —41,900 | —24,311 |
| | 5 mos. | 352 | 860,611 | 205,293 | 1,183,667 | 350,599 | 247,869 | 16,893 | 686,470 | 1,354,007 | 114.4 | —170,340 | —270,602 | —323,669 | —263,721 |
| Oklahoma City-Ada-Atoka | May | 132 | 19,379 | 231 | 21,418 | 4,663 | 2,112 | 706 | 10,504 | 19,666 | 91.8 | 1,752 | —474 | —4,421 | 5,911 |
| | 5 mos. | 132 | 107,595 | 1,345 | 117,699 | 22,205 | 7,687 | 3,796 | 53,796 | 95,732 | 81.3 | 21,967 | 9,893 | —10,413 | 26,330 |
| Pennsylvania | May | 10,270 | 28,941,572 | 5,145,604 | 37,683,303 | 3,898,126 | 6,604,762 | 771,535 | 13,200,587 | 25,690,548 | 68.2 | 11,992,755 | 7,941,584 | 6,900,323 | 3,552,667 |
| | 5 mos. | 10,270 | 136,666,987 | 28,153,358 | 180,807,114 | 17,289,508 | 36,663,148 | 3,580,343 | 67,235,382 | 130,946,232 | 72.4 | 49,860,882 | 32,026,571 | 28,147,486 | 21,159,475 |
| Long Island | May | 379 | 596,645 | 1,330,727 | 2,018,650 | 202,445 | 359,907 | 12,811 | 959,814 | 1,569,577 | 77.8 | 449,073 | 102,433 | —74,489 | 70,875 |
| | 5 mos. | 379 | 2,877,733 | 5,874,655 | 9,173,152 | 1,016,668 | 1,831,397 | 53,052 | 4,698,081 | 7,781,245 | 84.8 | 1,391,907 | 137,965 | —689,596 | —488,112 |
| Pennsylvania-Reading Seashore Lines | May | 411 | 268,003 | 123,371 | 412,886 | 79,785 | 63,386 | 7,444 | 269,377 | 435,792 | 105.5 | —22,906 | —102,604 | —177,698 | —247,705 |
| | 5 mos. | 411 | 1,354,322 | 510,839 | 1,956,465 | 408,617 | 450,509 | 35,057 | 1,379,257 | 2,355,364 | 120.4 | —398,899 | —770,186 | —1,135,096 | —1,091,134 |
| Pere Marquette | May | 2,114 | 2,433,813 | 73,402 | 2,650,852 | 379,820 | 551,714 | 63,713 | 987,279 | 2,081,899 | 78.5 | 568,953 | 382,911 | 254,308 | 25,047 |
| | 5 mos. | 2,114 | 12,614,695 | 336,351 | 13,572,987 | 1,668,725 | 2,808,780 | 319,786 | 5,114,725 | 10,390,348 | 76.6 | 3,182,639 | 2,282,196 | 1,702,805 | 704,435 |
| Pittsburg & Shawmut | May | 98 | 136,413 | ..... | 136,783 | 16,957 | 23,986 | 1,768 | 29,516 | 75,606 | 55.3 | 61,177 | 57,016 | 46,234 | —8,866 |
| | 5 mos. | 98 | 465,305 | ..... | 466,952 | 59,081 | 98,926 | 9,281 | 123,890 | 311,494 | 66.7 | 155,458 | 140,122 | 95,278 | —16,443 |
| Pittsburgh & West Virginia | May | 136 | 320,589 | 95 | 326,904 | 71,243 | 73,465 | 18,508 | 72,862 | 260,935 | 79.8 | 65,969 | 41,091 | 48,835 | 11,817 |
| | 5 mos. | 136 | 1,615,418 | 219 | 1,692,038 | 284,049 | 367,050 | 86,540 | 378,609 | 1,233,814 | 72.9 | 458,224 | 336,629 | 377,616 | 206,587 |
| Pittsburg, Shawmut & Northern | May | 190 | 94,735 | ..... | 95,136 | 16,285 | 20,755 | 935 | 25,968 | 69,387 | 72.9 | 25,749 | 20,874 | 12,295 | —13,285 |
| | 5 mos. | 190 | 515,827 | ..... | 519,659 | 62,258 | 88,781 | 5,452 | 162,446 | 347,431 | 66.8 | 172,228 | 145,743 | 98,557 | 23,759 |
| Reading | May | 1,449 | 4,467,680 | 242,201 | 4,935,968 | 401,936 | 918,905 | 72,194 | 1,859,251 | 3,393,751 | 68.8 | 1,542,217 | 1,078,288 | 1,045,229 | 947,193 |
| | 5 mos. | 1,450 | 22,480,218 | 1,304,052 | 24,896,935 | 1,900,286 | 4,851,727 | 353,245 | 9,803,645 | 17,639,753 | 70.9 | 7,257,182 | 5,192,136 | 4,832,731 | 4,160,073 |
| Richmond, Fredericksburg & Potomac | May | 118 | 469,971 | 172,590 | 781,445 | 143,797 | 148,281 | 10,565 | 287,635 | 639,930 | 81.9 | 141,515 | 87,085 | 9,750 | 60,724 |
| | 5 mos. | 118 | 2,089,357 | 1,548,550 | 4,276,944 | 462,319 | 723,191 | 49,661 | 1,625,307 | 3,140,056 | 73.4 | 1,136,888 | 818,920 | 399,343 | 400,666 |
| Rutland | May | 407 | 217,690 | 17,766 | 298,850 | 55,939 | 83,689 | 15,545 | 229,987 | 402,158 | 134.6 | —103,308 | —135,625 | —134,490 | —6,908 |
| | 5 mos. | 407 | 980,462 | 124,780 | 1,398,028 | 178,855 | 311,880 | 54,346 | 773,477 | 1,374,157 | 98.3 | 23,871 | —89,839 | —90,191 | —88,804 |
| St. Louis-San Francisco | May | 4,814 | 2,936,052 | 213,499 | 3,469,985 | 511,232 | 829,460 | 121,591 | 1,404,234 | 3,043,430 | 87.7 | 426,555 | 101,788 | 86,539 | 92,796 |
| | 5 mos. | 4,817 | 14,759,033 | 1,224,442 | 17,627,544 | 2,610,056 | 4,272,888 | 601,600 | 7,321,126 | 15,703,730 | 89.1 | 1,923,814 | 321,322 | 376,367 | 20,738 |
| St. Louis, San Francisco & Texas | May | 159 | 109,207 | 401 | 114,325 | 20,930 | 13,238 | 8,339 | 48,719 | 95,632 | 83.6 | 18,693 | 10,813 | —14,029 | —21,924 |
| | 5 mos. | 184 | 490,921 | 1,894 | 516,753 | 115,080 | 68,747 | 39,850 | 256,809 | 508,057 | 98.3 | 8,696 | —32,211 | —155,891 | —122,871 |

Continued on third right-hand page

## REVENUES AND EXPENSES OF RAILWAYS

MONTH OF MAY AND FIVE MONTHS OF CALENDAR YEAR 1940—CONTINUED

| Name of road | | Av. mileage operated during period | Operating revenues: Freight | Passenger | Total (inc. misc.) | Operating expenses: Maintenance of Way and structures | Maintenance of Equipment | Traffic | Transportation | Total | Operating ratio | Net from railway operation | Operating income | Net railway operating income 1940 | 1939 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| St. Louis Southwestern Lines | May | 1,649 | $1,535,060 | $22,876 | $1,626,754 | $270,816 | $280,147 | $84,972 | $497,280 | $1,212,883 | 74.6 | $413,871 | $301,468 | $182,110 | —$2,435 |
| | 5 mos. | 1,673 | 7,774,286 | 113,328 | 8,216,229 | 1,212,740 | 1,305,386 | 415,642 | 2,588,840 | 5,917,859 | 72.0 | 2,298,370 | 1,743,812 | 1,063,730 | 486,434 |
| Seaboard Air Line | May | 4,314 | 3,044,449 | 446,026 | 3,812,117 | 696,650 | 786,933 | 173,059 | 1,451,886 | 3,301,721 | 86.6 | 510,396 | 195,396 | 73,165 | 141,950 |
| | 5 mos. | 4,314 | 15,590,617 | 4,018,874 | 21,519,507 | 2,877,302 | 3,941,432 | 907,416 | 7,961,674 | 16,885,085 | 78.5 | 4,634,422 | 2,954,422 | 2,169,279 | 1,645,761 |
| Southern Railway | May | 6,594 | 7,030,244 | 609,444 | 8,319,490 | 1,091,324 | 1,515,508 | 163,585 | 2,873,279 | 5,977,267 | 71.8 | 2,342,223 | 1,644,461 | 1,368,532 | 1,099,888 |
| | 5 mos. | 6,600 | 35,091,199 | 3,429,114 | 41,858,780 | 5,446,581 | 7,346,762 | 823,152 | 14,696,852 | 29,969,272 | 71.6 | 11,889,508 | 8,450,479 | 7,129,056 | 6,181,661 |
| Alabama Great Southern | May | 315 | 598,092 | 44,513 | 686,754 | 88,361 | 140,403 | 12,979 | 193,910 | 458,569 | 66.8 | 228,185 | 148,866 | 148,606 | 144,085 |
| | 5 mos. | 315 | 2,691,532 | 212,513 | 3,113,861 | 442,803 | 669,428 | 63,894 | 936,347 | 2,229,848 | 71.6 | 884,013 | 567,641 | 588,531 | 611,985 |
| Cincinnati, New Orleans & Texas Pacific | May | 337 | 1,387,165 | 68,100 | 1,541,253 | 177,577 | 290,780 | 30,556 | 383,948 | 935,355 | 60.7 | 605,898 | 417,145 | 419,773 | 378,513 |
| | 5 mos. | 337 | 6,582,881 | 543,550 | 7,558,358 | 873,443 | 1,456,623 | 149,572 | 1,979,960 | 4,744,594 | 62.8 | 2,813,764 | 1,990,997 | 2,061,231 | 1,948,213 |
| Georgia Southern & Florida | May | 398 | 153,508 | 22,931 | 196,105 | 40,868 | 34,670 | 2,052 | 83,594 | 168,258 | 85.8 | 27,847 | 12,044 | 1,593 | —6,578 |
| | 5 mos. | 398 | 724,214 | 271,148 | 1,101,112 | 183,146 | 188,390 | 9,213 | 460,181 | 889,057 | 80.7 | 212,055 | 130,705 | 71,432 | 70,029 |
| New Orleans & Northeastern | May | 204 | 233,206 | 14,085 | 264,985 | 42,155 | 37,153 | 5,503 | 77,963 | 175,494 | 66.2 | 89,491 | 57,787 | 40,425 | 35,496 |
| | 5 mos. | 204 | 1,129,623 | 73,803 | 1,295,500 | 182,088 | 177,404 | 28,221 | 397,015 | 847,545 | 65.4 | 447,955 | 292,878 | 181,337 | 142,696 |
| Southern Pacific | May | 8,642 | 11,351,713 | 1,489,073 | 14,010,038 | 1,478,328 | 2,473,248 | 402,631 | 5,178,494 | 10,355,389 | 73.9 | 3,654,649 | 2,451,411 | 1,669,509 | 1,600,793 |
| | 5 mos. | 8,642 | 52,715,011 | 7,086,223 | 65,164,169 | 7,361,246 | 12,428,027 | 1,863,106 | 24,995,540 | 50,692,538 | 77.8 | 14,471,631 | 8,524,811 | 4,914,724 | 4,457,946 |
| Southern Pacific Steamship Lines | May | ... | 752,301 | 32,830 | 829,393 | 20,092 | 105,644 | 19,462 | 605,471 | 764,404 | 92.2 | 64,989 | 36,412 | 36,189 | 20,335 |
| | 5 mos. | .... | 3,454,029 | 135,883 | 3,775,572 | 83,130 | 527,531 | 95,687 | 2,686,366 | 3,465,817 | 91.8 | 309,755 | 191,740 | 187,325 | 137,805 |
| Texas & New Orleans | May | 4,417 | 2,970,724 | 268,221 | 3,525,274 | 612,262 | 652,275 | 127,355 | 1,272,607 | 2,865,205 | 81.3 | 660,069 | 348,112 | 111,590 | 335,460 |
| | 5 mos. | 4,417 | 15,662,363 | 1,356,280 | 18,480,727 | 2,810,135 | 3,228,321 | 635,683 | 6,329,577 | 14,025,811 | 75.9 | 4,454,916 | 2,893,746 | 1,599,763 | 1,640,059 |
| Spokane, Portland & Seattle | May | 948 | 674,392 | 26,485 | 756,255 | 151,314 | 88,385 | 10,105 | 256,712 | 537,092 | 71.0 | 219,163 | 135,488 | 77,771 | —45,466 |
| | 5 mos. | 948 | 3,058,396 | 121,782 | 3,450,646 | 631,731 | 430,819 | 51,140 | 1,279,016 | 2,533,307 | 73.4 | 917,339 | 548,537 | 318,845 | 101,012 |
| Tennessee Central | May | 286 | 199,335 | 4,294 | 218,316 | 41,632 | 32,467 | 7,372 | 72,080 | 165,175 | 75.7 | 53,141 | 39,111 | 26,651 | 4,229 |
| | 5 mos. | 286 | 1,019,428 | 24,047 | 1,109,446 | 190,469 | 169,206 | 34,658 | 379,850 | 824,892 | 74.4 | 284,554 | 210,654 | 132,600 | 55,011 |
| Texas & Pacific | May | 1,887 | 1,773,961 | 178,704 | 2,146,626 | 263,027 | 397,749 | 75,518 | 708,135 | 1,557,118 | 72.5 | 589,508 | 468,467 | 368,988 | 307,510 |
| | 5 mos. | 1,926 | 8,970,721 | 879,177 | 10,808,102 | 1,275,685 | 1,960,184 | 373,212 | 3,475,362 | 7,663,099 | 70.9 | 3,145,003 | 2,372,908 | 1,880,341 | 1,636,235 |
| Texas Mexican | May | 162 | 82,284 | 189 | 97,852 | 11,439 | 10,626 | 3,100 | 28,425 | 59,357 | 60.7 | 38,495 | 32,546 | 29,899 | 22,984 |
| | 5 mos. | 162 | 306,659 | 2,071 | 378,113 | 55,860 | 48,720 | 15,306 | 143,680 | 292,577 | 77.4 | 85,536 | 56,163 | 40,405 | 71,159 |
| Toledo, Peoria & Western | May | 239 | 172,479 | ..... | 175,899 | 47,081 | 14,778 | 17,367 | 42,177 | 138,825 | 78.9 | 37,074 | 24,361 | 9,616 | 15,796 |
| | 5 mos. | 239 | 921,595 | 44 | 934,640 | 214,393 | 73,212 | 86,275 | 217,556 | 649,884 | 69.5 | 284,756 | 195,313 | 117,508 | 100,298 |
| Union Pacific System | May | 9,889 | 10,057,758 | 1,240,396 | 12,421,770 | 1,180,859 | 2,660,181 | 499,033 | 4,266,174 | 9,363,148 | 75.4 | 3,058,622 | 1,856,384 | 1,280,517 | 875,208 |
| | 5 mos. | 9,893 | 49,469,983 | 5,861,488 | 60,706,521 | 5,478,640 | 12,327,338 | 2,180,479 | 21,841,882 | 45,366,784 | 74.7 | 15,339,737 | 8,710,537 | 5,559,482 | 4,052,519 |
| Utah | May | 111 | 39,557 | ..... | 39,592 | 7,501 | 18,773 | 351 | 11,191 | 42,627 | 107.7 | —3,035 | —8,692 | —5,099 | —6,889 |
| | 5 mos. | 111 | 33,020 | ..... | 333,715 | 40,962 | 119,402 | 2,031 | 95,528 | 279,608 | 83.8 | 54,107 | 9,447 | 18,692 | 17,703 |
| Virginian | May | 639 | 2,043,602 | 2,509 | 2,094,490 | 173,517 | 392,298 | 25,118 | 280,649 | 902,184 | 43.1 | 1,192,306 | 862,306 | 929,791 | 397,371 |
| | 5 mos. | 639 | 10,208,430 | 12,514 | 10,463,688 | 849,661 | 1,968,444 | 126,248 | 1,527,625 | 4,628,046 | 44.2 | 5,835,642 | 4,295,642 | 4,510,145 | 2,634,814 |
| Wabash | May | 2,409 | 3,165,782 | 170,528 | 3,604,342 | 526,204 | 592,273 | 153,311 | 1,428,994 | 2,863,018 | 79.4 | 741,324 | 508,195 | 183,040 | 96,971 |
| | 5 mos. | 2,409 | 16,128,837 | 936,937 | 18,450,251 | 2,406,054 | 3,116,089 | 736,901 | 7,559,090 | 14,620,423 | 79.2 | 3,829,828 | 2,672,619 | 996,404 | 506,548 |
| Ann Arbor | May | 294 | 319,916 | 1,664 | 330,893 | 42,963 | 71,079 | 13,201 | 137,946 | 277,358 | 83.8 | 53,535 | 28,903 | 16,131 | —1,734 |
| | 5 mos. | 294 | 1,612,812 | 8,315 | 1,661,365 | 153,833 | 360,483 | 67,667 | 744,273 | 1,386,736 | 83.5 | 274,629 | 161,699 | 97,064 | —3,553 |
| Western Maryland | May | 859 | 1,383,091 | 5,458 | 1,440,287 | 206,347 | 309,785 | 38,440 | 382,632 | 990,797 | 68.8 | 449,490 | 339,490 | 348,063 | 173,624 |
| | 5 mos. | 859 | 7,396,169 | 27,676 | 7,717,847 | 912,166 | 1,623,754 | 197,591 | 2,038,653 | 5,020,860 | 65.1 | 2,696,987 | 2,146,987 | 2,165,992 | 1,369,584 |
| Western Pacific | May | 1,208 | 1,424,985 | 35,872 | 1,499,121 | 298,436 | 211,490 | 64,759 | 544,100 | 1,176,696 | 78.5 | 322,425 | 235,616 | 133,211 | —17,644 |
| | 5 mos. | 1,208 | 6,070,065 | 155,732 | 6,362,030 | 1,130,733 | 1,067,208 | 305,376 | 2,556,192 | 5,340,557 | 83.9 | 1,021,473 | 593,408 | 182,677 | —189,624 |
| Wheeling & Lake Erie | May | 508 | 1,353,337 | ..... | 1,423,829 | 177,437 | 233,793 | 36,511 | 404,909 | 886,132 | 62.2 | 537,697 | 329,813 | 415,829 | 131,930 |
| | 5 mos. | 508 | 6,081,205 | 18 | 6,327,575 | 675,842 | 1,278,245 | 183,148 | 1,921,251 | 4,222,261 | 66.7 | 2,105,314 | 1,281,271 | 1,671,366 | 975,151 |

*Table of Freight Operating Statistics appears on next left-hand page*

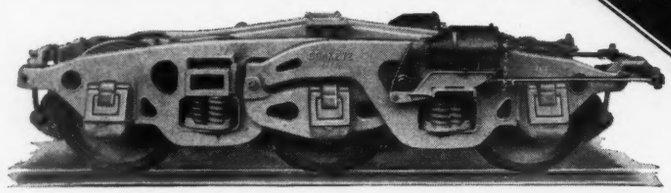
## Freight Operating Statistics of Large Steam Railways—Selected Items for the Month of April,

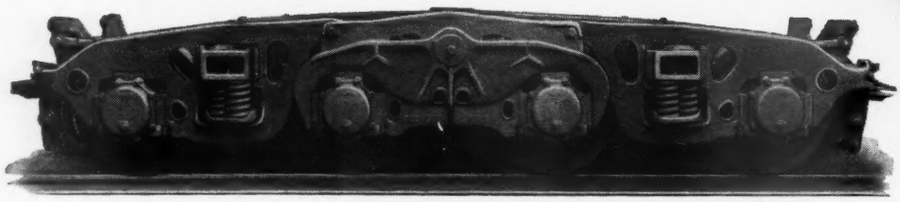
| Region, road, and year | | Miles of road operated | Train miles | Locomotive-miles: Principal and helper | Locomotive-miles: Light | Car-miles: Loaded (*thousands*) | Car-miles: Per cent loaded | Ton-miles (*thousands*): Gross, excluding locomotives and tenders | Ton-miles (*thousands*): Net, revenue and non-revenue | Number of road locomotives on line: Serviceable: Not stored | Number of road locomotives on line: Serviceable: Stored | Number of road locomotives on line: Unserviceable | Number of road locomotives on line: Per cent unserviceable |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| New England Region: | | | | | | | | | | | | | |
| Boston & Albany | 1940 | 362 | 124,879 | 128,872 | 9,108 | 2,802 | 65.5 | 156,272 | 52,557 | 61 | .. | 25 | 29.1 |
| | 1939 | 374 | 128,542 | 132,727 | 9,357 | 2,774 | 64.5 | 155,756 | 51,710 | 58 | 3 | 29 | 32.2 |
| Boston & Maine | 1940 | 1,892 | 278,778 | 310,817 | 22,913 | 9,507 | 67.0 | 547,268 | 196,598 | 124 | .. | 51 | 29.1 |
| | 1939 | 1,917 | 259,099 | 287,686 | 22,676 | 9,269 | 67.9 | 524,483 | 190,394 | 113 | 5 | 99 | 45.6 |
| N. Y., New H. & Hartf. | 1940 | 1,849 | 326,762 | 409,902 | 29,714 | 11,626 | 64.7 | 647,452 | 228,786 | 178 | 15 | 54 | 22.2 |
| | 1939 | 1,858 | 339,908 | 428,185 | 26,328 | 12,225 | 65.4 | 668,407 | 235,951 | 169 | 1 | 97 | 35.2 |
| Great Lakes Region: | | | | | | | | | | | | | |
| Delaware & Hudson | 1940 | 846 | 230,810 | 307,920 | 32,188 | 7,607 | 62.2 | 489,391 | 227,770 | 121 | 41 | 78 | 32.5 |
| | 1939 | 830 | 213,157 | 280,594 | 30,348 | 7,264 | 64.3 | 447,649 | 207,695 | 120 | 50 | 86 | 33.6 |
| Del., Lack. & Western | 1940 | 983 | 352,588 | 397,206 | 53,617 | 12,232 | 65.6 | 727,900 | 280,827 | 140 | 4 | 61 | 29.8 |
| | 1939 | 983 | 358,953 | 410,267 | 63,712 | 12,565 | 65.4 | 762,239 | 307,311 | 132 | 2 | 79 | 37.1 |
| Erie (incl. Chi. & Erie) | 1940 | 2,268 | 613,921 | 643,820 | 36,625 | 27,308 | 64.8 | 1,655,438 | 616,071 | 209 | 44 | 177 | 41.2 |
| | 1939 | 2,290 | 581,332 | 613,893 | 34,863 | 25,811 | 67.2 | 1,491,736 | 551,876 | 191 | 48 | 231 | 49.1 |
| Grand Trunk Western | 1940 | 1,023 | 255,720 | 258,592 | 1,502 | 7,378 | 60.3 | 466,579 | 161,014 | 74 | 1 | 24 | 24.2 |
| | 1939 | 1,023 | 228,847 | 229,698 | 1,247 | 6,296 | 61.3 | 383,973 | 125,499 | 67 | 1 | 43 | 38.7 |
| Lehigh Valley | 1940 | 1,265 | 320,058 | 348,827 | 49,224 | 11,840 | 63.8 | 745,483 | 300,189 | 133 | .. | 87 | 39.5 |
| | 1939 | 1,266 | 303,144 | 334,946 | 52,924 | 12,537 | 65.3 | 790,067 | 339,692 | 118 | .. | 109 | 48.0 |
| New York Central | 1940 | 10,565 | 2,569,951 | 2,713,537 | 160,605 | 84,257 | 58.6 | 5,689,579 | 2,279,574 | 856 | 173 | 342 | 24.9 |
| | 1939 | 10,613 | 2,262,407 | 2,349,413 | 114,491 | 72,787 | 59.9 | 4,613,379 | 1,714,790 | 722 | 258 | 480 | 32.9 |
| New York, Chi. & St. L. | 1940 | 1,672 | 482,543 | 490,556 | 5,938 | 16,974 | 62.1 | 1,035,834 | 371,164 | 166 | 12 | 20 | 10.1 |
| | 1939 | 1,672 | 449,465 | 455,915 | 5,418 | 16,431 | 64.4 | 961,511 | 338,711 | 143 | 15 | 40 | 20.2 |
| Pere Marquette | 1940 | 2,080 | 367,633 | 376,081 | 8,237 | 10,158 | 60.9 | 655,861 | 242,582 | 120 | 1 | 39 | 24.4 |
| | 1939 | 2,081 | 322,701 | 330,467 | 6,656 | 8,117 | 61.3 | 509,080 | 180,521 | 104 | 6 | 54 | 32.9 |
| Pitts. & Lake Erie | 1940 | 233 | 67,566 | 69,868 | ..... | 2,524 | 58.2 | 221,786 | 123,301 | 30 | 22 | 19 | 26.8 |
| | 1939 | 233 | 35,368 | 36,376 | ..... | 1,277 | 63.1 | 89,300 | 43,319 | 17 | 15 | 39 | 54.9 |
| Wabash | 1940 | 2,397 | 548,959 | 561,153 | 11,437 | 17,021 | 62.5 | 1,028,153 | 347,295 | 149 | 15 | 105 | 39.0 |
| | 1939 | 2,397 | 535,012 | 546,761 | 11,287 | 16,721 | 63.8 | 993,270 | 337,529 | 134 | 7 | 134 | 48.7 |
| Central Eastern Region: | | | | | | | | | | | | | |
| Baltimore & Ohio | 1940 | 6,262 | 1,401,470 | 1,725,707 | 186,258 | 43,243 | 61.2 | 2,976,010 | 1,305,326 | 639 | 130 | 437 | 36.2 |
| | 1939 | 6,279 | 1,164,614 | 1,427,270 | 144,971 | 36,421 | 65.4 | 2,280,347 | 944,919 | 575 | 180 | 488 | 39.3 |
| Central of New Jersey | 1940 | 679 | 167,043 | 186,481 | 31,996 | 5,011 | 59.2 | 356,440 | 166,773 | 79 | 7 | 72 | 45.6 |
| | 1939 | 680 | 151,238 | 171,890 | 33,651 | 5,018 | 61.0 | 349,946 | 167,098 | 78 | 3 | 76 | 48.4 |
| Chicago & Eastern Ill. | 1940 | 925 | 166,325 | 166,759 | 2,903 | 4,050 | 63.8 | 250,520 | 97,470 | 56 | 5 | 29 | 32.2 |
| | 1939 | 927 | 161,378 | 161,378 | 2,686 | 4,052 | 63.9 | 256,878 | 103,845 | 55 | 2 | 37 | 39.4 |
| Elgin, Joliet & Eastern | 1940 | 390 | 90,918 | 92,163 | 1,361 | 2,248 | 60.5 | 168,325 | 80,966 | 51 | 3 | 23 | 29.9 |
| | 1939 | 390 | 92,664 | 93,799 | 1,271 | 2,258 | 59.2 | 171,213 | 80,688 | 58 | 1 | 22 | 27.2 |
| Long Island | 1940 | 375 | 25,952 | 27,332 | 16,462 | 277 | 52.2 | 20,973 | 8,058 | 32 | 7 | 9 | 18.8 |
| | 1939 | 379 | 27,429 | 28,428 | 17,468 | 279 | 50.4 | 21,797 | 8,442 | 34 | 3 | 11 | 22.9 |
| Pennsylvania System | 1940 | 9,994 | 2,672,780 | 3,249,606 | 351,008 | 101,926 | 60.6 | 6,957,452 | 2,983,187 | 1,177 | 358 | 708 | 31.6 |
| | 1939 | 9,998 | 2,354,623 | 2,873,430 | 321,860 | 88,761 | 60.6 | 5,814,155 | 2,303,058 | 1,081 | 189 | 1,053 | 45.3 |
| Reading | 1940 | 1,442 | 397,263 | 438,954 | 50,812 | 11,625 | 60.0 | 852,542 | 409,026 | 211 | 13 | 144 | 39.1 |
| | 1939 | 1,443 | 336,701 | 371,288 | 46,488 | 9,846 | 62.4 | 676,493 | 309,193 | 182 | 7 | 165 | 46.6 |
| Pocahontas Region: | | | | | | | | | | | | | |
| Chesapeake & Ohio | 1940 | 3,044 | 851,264 | 898,440 | 40,512 | 38,579 | 56.6 | 3,244,653 | 1,765,876 | 380 | 47 | 86 | 16.8 |
| | 1939 | 3,057 | 507,759 | 519,776 | 14,225 | 16,604 | 61.2 | 1,122,034 | 514,762 | 273 | 144 | 118 | 22.1 |
| Norfolk & Western | 1940 | 2,169 | 618,014 | 648,759 | 37,373 | 27,068 | 57.1 | 2,257,577 | 1,173,671 | 271 | 46 | 40 | 11.2 |
| | 1939 | 2,169 | 392,398 | 405,389 | 20,392 | 13,840 | 66.7 | 867,007 | 377,450 | 194 | 136 | 27 | 7.6 |
| Southern Region: | | | | | | | | | | | | | |
| Atlantic Coast Line | 1940 | 5,075 | 672,520 | 683,980 | 9,503 | 14,764 | 60.5 | 896,562 | 307,974 | 270 | 13 | 43 | 13.2 |
| | 1939 | 5,081 | 692,627 | 700,136 | 9,824 | 15,067 | 58.6 | 894,137 | 284,512 | 264 | 10 | 102 | 27.1 |
| Central of Georgia | 1940 | 1,831 | 259,403 | 261,102 | 3,950 | 5,594 | 69.4 | 322,620 | 124,762 | 98 | .. | 22 | 18.3 |
| | 1939 | 1,838 | 243,940 | 247,935 | 3,208 | 5,302 | 71.7 | 292,821 | 110,562 | 94 | .. | 28 | 23.0 |
| Illinois Central (incl. | 1940 | 6,557 | 1,251,672 | 1,257,927 | 23,780 | 34,752 | 59.7 | 2,285,893 | 911,966 | 588 | 67 | 186 | 22.1 |
| Y. & M. V.) | 1939 | 6,537 | 1,301,477 | 1,307,608 | 24,643 | 34,806 | 59.9 | 2,311,229 | 929,790 | 588 | 35 | 224 | 26.4 |
| Louisville & Nashville | 1940 | 4,862 | 1,089,442 | 1,160,742 | 30,716 | 26,300 | 57.3 | 1,913,232 | 880,467 | 362 | 35 | 93 | 19.0 |
| | 1939 | 4,899 | 854,651 | 892,833 | 18,116 | 18,402 | 61.7 | 1,165,944 | 476,189 | 299 | 49 | 201 | 36.6 |
| Seaboard Air Line | 1940 | 4,301 | 606,961 | 626,627 | 4,243 | 14,507 | 62.6 | 883,692 | 320,348 | 252 | 3 | 52 | 16.9 |
| | 1939 | 4,305 | 578,890 | 601,724 | 5,236 | 14,602 | 62.2 | 861,249 | 292,005 | 240 | 3 | 59 | 19.5 |
| Southern | 1940 | 6,548 | 1,344,888 | 1,366,758 | 19,982 | 30,080 | 65.0 | 1,803,004 | 723,895 | 485 | .. | 157 | 24.5 |
| | 1939 | 6,626 | 1,177,634 | 1,193,979 | 18,332 | 27,547 | 66.6 | 1,549,216 | 584,600 | 475 | 4 | 185 | 27.9 |
| Northwestern Region: | | | | | | | | | | | | | |
| Chi. & North Western | 1940 | 8,324 | 771,319 | 795,037 | 16,843 | 22,831 | 61.1 | 1,451,049 | 513,698 | 283 | 89 | 255 | 40.7 |
| | 1939 | 8,370 | 755,359 | 778,583 | 18,853 | 22,034 | 63.8 | 1,348,147 | 494,765 | 289 | 122 | 266 | 39.3 |
| Chicago Great Western | 1940 | 1,447 | 241,421 | 242,511 | 4,387 | 7,042 | 62.1 | 437,629 | 154,441 | 67 | .. | 16 | 19.3 |
| | 1939 | 1,450 | 246,474 | 246,819 | 4,606 | 7,047 | 61.5 | 439,812 | 153,047 | 64 | 3 | 20 | 23.0 |
| Chi., Milw., St. P. & Pac. | 1940 | 10,874 | 1,147,227 | 1,189,856 | 44,050 | 33,465 | 62.1 | 2,148,145 | 867,371 | 396 | 101 | 158 | 24.1 |
| | 1939 | 10,934 | 1,133,585 | 1,166,680 | 38,873 | 32,089 | 63.1 | 2,030,989 | 813,805 | 401 | 107 | 157 | 23.6 |
| Chi., St. P., Minneap. & Om. | 1940 | 1,619 | 193,476 | 200,101 | 7,444 | 4,423 | 65.5 | 268,998 | 102,294 | 88 | 34 | 16 | 11.6 |
| | 1939 | 1,619 | 188,268 | 195,770 | 8,226 | 4,289 | 65.8 | 256,613 | 95,190 | 95 | 24 | 18 | 13.1 |
| Great Northern | 1940 | 7,973 | 744,873 | 738,663 | 24,397 | 25,206 | 64.1 | 1,682,543 | 708,350 | 328 | 64 | 145 | 27.0 |
| | 1939 | 7,976 | 669,068 | 662,369 | 25,860 | 22,909 | 65.1 | 1,467,975 | 599,059 | 330 | 63 | 151 | 27.8 |
| Minneap., St. P. & S. St. M. | 1940 | 4,261 | 368,550 | 373,564 | 4,108 | 8,681 | 63.8 | 523,396 | 206,802 | 115 | .. | 23 | 16.7 |
| | 1939 | 4,266 | 350,471 | 354,586 | 3,838 | 8,026 | 65.9 | 463,134 | 179,566 | 119 | 1 | 28 | 18.9 |
| Northern Pacific | 1940 | 6,423 | 654,470 | 691,862 | 39,367 | 22,766 | 67.3 | 1,407,546 | 602,045 | 288 | 65 | 93 | 20.9 |
| | 1939 | 6,424 | 597,386 | 631,065 | 33,311 | 20,569 | 69.7 | 1,230,024 | 521,545 | 322 | 25 | 100 | 22.4 |
| Central Western Region: | | | | | | | | | | | | | |
| Alton | 1940 | 914 | 187,136 | 194,848 | 1,077 | 3,863 | 60.5 | 247,476 | 87,606 | 53 | 15 | 15 | 18.1 |
| | 1939 | 914 | 189,209 | 201,093 | 1,557 | 4,176 | 59.1 | 280,430 | 101,612 | 54 | 17 | 19 | 21.1 |
| Atch., Top. & S. Fe (incl. | 1940 | 13,414 | 1,880,050 | 2,027,114 | 96,119 | 53,053 | 59.8 | 3,467,695 | 1,083,440 | 598 | 68 | 183 | 21.6 |
| G. C. & S. F. and P. & S. F.) | 1939 | 13,465 | 1,709,010 | 1,824,209 | 74,266 | 47,116 | 62.2 | 2,952,154 | 944,831 | 548 | 83 | 270 | 30.0 |
| Chi., Burl. & Quincy | 1940 | 8,969 | 1,022,944 | 1,047,390 | 36,186 | 31,091 | 64.2 | 1,887,493 | 742,097 | 410 | 44 | 97 | 17.6 |
| | 1939 | 8,889 | 1,050,461 | 1,083,284 | 36,967 | 30,626 | 63.3 | 1,904,378 | 749,878 | 418 | 55 | 98 | 17.2 |
| Chi., Rock I. & Pac. (incl. | 1940 | 7,881 | 1,043,423 | 1,048,056 | 6,237 | 25,449 | 57.2 | 1,654,947 | 571,872 | 315 | 60 | 164 | 30.4 |
| Chi., Rock I. & Gulf) | 1939 | 7,834 | 1,066,029 | 1,076,267 | 6,516 | 25,545 | 59.3 | 1,613,883 | 563,832 | 335 | 65 | 170 | 29.8 |
| Denver & R. G. Wn. | 1940 | 2,554 | 248,783 | 274,571 | 27,766 | 7,401 | 66.8 | 470,835 | 194,853 | 123 | 40 | 24 | 12.8 |
| | 1939 | 2,555 | 236,799 | 261,483 | 26,673 | 6,730 | 65.9 | 427,330 | 175,742 | 134 | 38 | 24 | 12.2 |
| Southern Pacific—Pacific | 1940 | 8,553 | 1,465,048 | 1,581,109 | 179,216 | 51,503 | 61.1 | 3,383,808 | 1,142,684 | 572 | 61 | 147 | 18.8 |
| Lines | 1939 | 8,554 | 1,383,187 | 1,505,810 | 171,821 | 47,347 | 61.8 | 3,023,634 | 1,004,857 | 541 | 42 | 185 | 24.1 |
| Union Pacific | 1940 | 9,889 | 1,712,934 | 1,777,974 | 101,489 | 56,860 | 65.3 | 3,444,831 | 1,252,570 | 490 | 58 | 304 | 35.7 |
| | 1939 | 9,901 | 1,762,762 | 1,824,606 | 95,330 | 55,548 | 63.0 | 3,450,190 | 1,203,138 | 520 | 70 | 280 | 32.2 |
| Southwestern Region: | | | | | | | | | | | | | |
| Mo.-Kans.-Texas Lines | 1940 | 3,281 | 353,027 | 355,573 | 5,081 | 8,659 | 61.9 | 522,015 | 178,938 | 83 | .. | 90 | 52.0 |
| | 1939 | 3,282 | 359,271 | 361,874 | 5,131 | 9,350 | 62.7 | 561,981 | 203,450 | 88 | 1 | 112 | 55.7 |
| Missouri Pacific | 1940 | 7,120 | 1,012,065 | 1,031,569 | 20,198 | 29,552 | 62.1 | 1,866,056 | 692,550 | 351 | 99 | 70 | 13.5 |
| | 1939 | 7,146 | 982,760 | 1,012,237 | 20,904 | 28,840 | 61.7 | 1,852,634 | 694,215 | 354 | 80 | 91 | 17.3 |
| Texas & Pacific | 1940 | 1,932 | 261,182 | 261,182 | 1,973 | 8,057 | 58.0 | 532,856 | 178,292 | 71 | 23 | 94 | 50.0 |
| | 1939 | 1,932 | 257,193 | 257,193 | 1,683 | 7,519 | 60.0 | 477,129 | 162,665 | 78 | 10 | 97 | 52.4 |
| St. Louis-San Francisco | 1940 | 4,778 | 642,642 | 649,042 | 8,278 | 14,007 | 59.2 | 904,448 | 343,482 | 263 | 66 | 26 | 7.3 |
| | 1939 | 4,804 | 673,578 | 679,505 | 8,872 | 13,989 | 60.6 | 888,594 | 343,446 | 250 | 72 | 52 | 13.9 |
| St. Louis Southwestern Lines | 1940 | 1,633 | 258,165 | 259,083 | 3,320 | 7,239 | 63.2 | 433,214 | 154,167 | 76 | 20 | 14 | 12.7 |
| | 1939 | 1,684 | 251,411 | 252,843 | 3,224 | 7,104 | 62.0 | 428,475 | 150,378 | 70 | 32 | 21 | 17.1 |
| Texas & New Orleans | 1940 | 4,415 | 590,948 | 590,982 | 5,586 | 14,178 | 63.6 | 907,541 | 337,654 | 204 | 13 | 49 | 18.4 |
| | 1939 | 4,415 | 558,966 | 559,005 | 4,521 | 14,006 | 64.7 | 857,733 | 319,576 | 208 | 15 | 47 | 17.4 |

*Compiled by the Bureau of Statistics, Interstate Commerce Commission. Subject to revision.*

## 1940, Compared with April, 1939, for Roads with Annual Operating Revenues Above $25,000,000

| Region, road, and year | Number of freight cars on line: Home | Foreign | Total | Per cent unserviceable | Gross ton-miles per train-hour, excluding locomotives and tenders | Gross ton-miles per train-mile, excluding locomotives and tenders | Net ton-miles per train-mile | Net ton-miles per loaded car-mile | Net ton-miles per car-day | Car-miles per car-day | Net ton-miles per mile of road per day | Pounds of coal per 1,000 gross ton-miles, including locomotives and tenders | Locomotive-miles per locomotive-day |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **New England Region:** | | | | | | | | | | | | | |
| Boston & Albany 1940 | 947 | 4,161 | 5,108 | 2.2 | 20,511 | 1,259 | 423 | 18.8 | 337 | 27.4 | 4,840 | 165 | 56.7 |
| 1939 | 1,065 | 3,919 | 4,984 | 2.6 | 19,776 | 1,232 | 409 | 18.6 | 336 | 27.9 | 4,609 | 166 | 56.4 |
| Boston & Maine 1940 | 5,185 | 7,054 | 12,239 | 5.8 | 28,596 | 1,969 | 707 | 20.7 | 546 | 39.4 | 3,464 | 98 | 68.0 |
| 1939 | 6,505 | 7,553 | 14,058 | 8.5 | 28,148 | 2,029 | 736 | 20.5 | 445 | 31.9 | 3,311 | 98 | 50.6 |
| N. Y., New H. & Hartf. 1940 | 7,216 | 11,703 | 18,919 | 4.1 | 28,970 | 2,013 | 711 | 19.7 | 419 | 32.9 | 4,124 | 105 | 65.2 |
| 1939 | 7,722 | 11,506 | 19,228 | 8.1 | 28,495 | 1,995 | 704 | 19.3 | 396 | 31.4 | 4,233 | 102 | 61.2 |
| **Great Lakes Region:** | | | | | | | | | | | | | |
| Delaware & Hudson 1940 | 8,023 | 3,334 | 11,357 | 3.7 | 32,740 | 2,131 | 992 | 29.9 | 672 | 36.1 | 8,974 | 118 | 48.9 |
| 1939 | 6,795 | 3,610 | 10,405 | 6.0 | 31,904 | 2,112 | 980 | 28.6 | 624 | 33.9 | 8,341 | 116 | 43.8 |
| Del., Lack. & Western 1940 | 11,125 | 5,496 | 16,621 | 6.4 | 36,473 | 2,084 | 804 | 23.0 | 553 | 36.7 | 9,523 | 133 | 77.5 |
| 1939 | 12,182 | 6,615 | 18,797 | 13.9 | 37,977 | 2,153 | 868 | 24.5 | 544 | 34.0 | 10,421 | 134 | 78.7 |
| Erie (incl. Chi. & Erie) 1940 | 16,487 | 12,182 | 28,669 | 3.9 | 46,249 | 2,717 | 1,011 | 22.6 | 701 | 48.0 | 9,055 | 94 | 58.8 |
| 1939 | 16,538 | 11,670 | 28,208 | 6.2 | 44,264 | 2,587 | 957 | 21.4 | 647 | 45.0 | 8,033 | 100 | 50.9 |
| Grand Trunk Western 1940 | 4,199 | 6,373 | 10,572 | 6.2 | 36,310 | 1,830 | 632 | 21.8 | 512 | 39.0 | 5,246 | 97 | 95.0 |
| 1939 | 4,799 | 5,124 | 9,923 | 14.5 | 34,348 | 1,684 | 550 | 19.9 | 424 | 34.7 | 4,089 | 93 | 75.4 |
| Lehigh Valley 1940 | 9,580 | 7,184 | 16,764 | 2.3 | 44,300 | 2,363 | 952 | 25.4 | 568 | 35.1 | 7,910 | 113 | 64.3 |
| 1939 | 10,123 | 9,280 | 19,403 | 2.0 | 47,230 | 2,640 | 1,135 | 27.1 | 585 | 33.1 | 8,944 | 107 | 60.1 |
| New York Central 1940 | 88,492 | 54,713 | 143,205 | 12.1 | 38,119 | 2,228 | 893 | 27.1 | 537 | 33.9 | 7,192 | 102 | 78.4 |
| 1939 | 91,042 | 51,090 | 142,132 | 19.0 | 36,073 | 2,056 | 764 | 23.6 | 393 | 27.9 | 5,386 | 107 | 63.8 |
| New York, Chi. & St. L. 1940 | 6,802 | 7,272 | 14,074 | 2.7 | 40,916 | 2,150 | 770 | 21.9 | 857 | 63.1 | 7,400 | 94 | 89.4 |
| 1939 | 7,245 | 6,805 | 14,050 | 5.0 | 41,384 | 2,142 | 755 | 20.6 | 797 | 60.0 | 6,753 | 90 | 83.2 |
| Pere Marquette 1940 | 8,637 | 7,678 | 16,315 | 2.7 | 31,495 | 1,790 | 662 | 23.9 | 500 | 34.4 | 3,888 | 94 | 87.0 |
| 1939 | 9,592 | 5,509 | 15,101 | 3.9 | 28,418 | 1,583 | 561 | 22.2 | 391 | 28.7 | 2,892 | 102 | 76.0 |
| Pitts. & Lake Erie 1940 | 15,527 | 3,485 | 19,012 | 20.8 | 41,949 | 3,283 | 1,825 | 48.9 | 221 | 7.8 | 17,640 | 87 | 36.3 |
| 1939 | 9,690 | 8,172 | 17,862 | 33.5 | 32,807 | 2,525 | 1,225 | 33.9 | 82 | 3.8 | 6,197 | 120 | 19.0 |
| Wabash 1940 | 12,223 | 8,638 | 20,861 | 10.0 | 39,754 | 1,885 | 637 | 20.4 | 554 | 43.5 | 4,830 | 117 | 74.4 |
| 1939 | 12,919 | 8,005 | 20,924 | 11.9 | 39,401 | 1,871 | 636 | 20.2 | 532 | 41.3 | 4,694 | 117 | 70.9 |
| **Central Eastern Region:** | | | | | | | | | | | | | |
| Baltimore & Ohio 1940 | 58,026 | 25,132 | 83,158 | 11.3 | 29,563 | 2,152 | 944 | 30.2 | 532 | 28.8 | 6,948 | 142 | 56.1 |
| 1939 | 58,860 | 20,156 | 79,016 | 19.1 | 28,993 | 1,984 | 822 | 25.9 | 396 | 23.4 | 5,016 | 144 | 45.5 |
| Central of New Jersey 1940 | 9,498 | 10,607 | 20,105 | 22.6 | 28,747 | 2,252 | 1,053 | 33.3 | 282 | 14.3 | 8,187 | 137 | 60.3 |
| 1939 | 9,768 | 10,403 | 20,171 | 30.5 | 28,635 | 2,439 | 1,164 | 33.3 | 273 | 13.4 | 8,191 | 134 | 56.9 |
| Chicago & Eastern Ill. 1940 | 3,324 | 2,998 | 6,322 | 9.5 | 28,323 | 1,511 | 588 | 24.1 | 512 | 33.3 | 3,512 | 133 | 66.1 |
| 1939 | 3,299 | 3,174 | 6,473 | 2.8 | 28,996 | 1,600 | 647 | 25.6 | 542 | 33.1 | 3,734 | 130 | 61.7 |
| Elgin, Joliet & Eastern 1940 | 8,482 | 3,503 | 11,985 | 4.2 | 17,328 | 1,902 | 915 | 36.0 | 222 | 10.2 | 6,920 | 124 | 57.4 |
| 1939 | 8,471 | 3,160 | 11,631 | 6.9 | 18,076 | 1,899 | 895 | 35.7 | 229 | 10.8 | 6,896 | 121 | 54.0 |
| Long Island 1940 | 137 | 3,571 | 3,708 | 1.3 | 5,693 | 826 | 317 | 29.1 | 79 | 5.2 | 716 | 317 | 45.8 |
| 1939 | 288 | 3,198 | 3,486 | 5.2 | 5,679 | 822 | 318 | 30.3 | 80 | 5.2 | 742 | 345 | 47.2 |
| Pennsylvania System 1940 | 198,262 | 58,633 | 256,895 | 14.7 | 38,871 | 2,648 | 1,135 | 29.3 | 390 | 22.0 | 9,950 | 111 | 59.5 |
| 1939 | 201,458 | 47,047 | 248,505 | 22.1 | 38,835 | 2,511 | 995 | 25.9 | 310 | 19.7 | 7,678 | 118 | 50.5 |
| Reading 1940 | 24,442 | 11,421 | 35,863 | 18.5 | 27,725 | 2,154 | 1,033 | 35.2 | 374 | 17.7 | 9,455 | 138 | 50.3 |
| 1939 | 25,344 | 9,317 | 34,661 | 25.9 | 24,098 | 2,020 | 923 | 31.4 | 291 | 14.8 | 7,142 | 148 | 43.7 |
| **Pocahontas Region:** | | | | | | | | | | | | | |
| Chesapeake & Ohio 1940 | 45,070 | 15,379 | 60,449 | 2.7 | 55,585 | 3,864 | 2,103 | 45.8 | 972 | 37.5 | 19,337 | 73 | 67.2 |
| 1939 | 53,172 | 9,077 | 62,249 | 2.6 | 38,464 | 2,230 | 1,023 | 31.0 | 281 | 14.8 | 5,613 | 98 | 35.9 |
| Norfolk & Western 1940 | 35,960 | 5,065 | 41,025 | 4.7 | 56,184 | 3,694 | 1,920 | 43.4 | 964 | 38.9 | 18,037 | 91 | 70.5 |
| 1939 | 45,594 | 4,283 | 49,877 | 3.8 | 38,343 | 2,233 | 972 | 27.3 | 276 | 15.2 | 5,801 | 121 | 42.8 |
| **Southern Region:** | | | | | | | | | | | | | |
| Atlantic Coast Line 1940 | 14,661 | 7,384 | 22,045 | 16.1 | 24,530 | 1,336 | 459 | 20.9 | 456 | 36.1 | 2,023 | 111 | 76.0 |
| 1939 | 16,145 | 8,209 | 24,354 | 20.6 | 23,766 | 1,294 | 412 | 18.9 | 382 | 34.5 | 1,867 | 109 | 69.0 |
| Central of Georgia 1940 | 4,945 | 2,620 | 7,565 | 2.5 | 24,716 | 1,250 | 483 | 22.3 | 549 | 35.4 | 2,271 | 121 | 80.3 |
| 1939 | 4,881 | 2,690 | 7,571 | 2.3 | 23,678 | 1,205 | 455 | 20.9 | 470 | 31.4 | 2,005 | 120 | 74.7 |
| Illinois Central (incl. 1940 | 31,999 | 14,500 | 46,499 | 3.3 | 30,985 | 1,847 | 737 | 26.2 | 671 | 42.9 | 4,636 | 133 | 56.6 |
| Y. & M. V.) 1939 | 27,100 | 15,116 | 42,216 | 3.2 | 29,975 | 1,794 | 722 | 26.7 | 712 | 44.5 | 4,741 | 135 | 56.4 |
| Louisville & Nashville 1940 | 35,391 | 11,141 | 46,532 | 11.6 | 28,028 | 1,759 | 810 | 33.5 | 636 | 33.1 | 6,036 | 126 | 84.7 |
| 1939 | 43,783 | 8,335 | 52,118 | 17.4 | 23,101 | 1,366 | 558 | 25.9 | 312 | 19.5 | 3,240 | 159 | 59.2 |
| Seaboard Air Line 1940 | 11,920 | 6,079 | 17,999 | 4.9 | 25,890 | 1,475 | 535 | 22.1 | 580 | 41.9 | 2,483 | 123 | 76.1 |
| 1939 | 11,736 | 5,414 | 17,150 | 4.4 | 26,379 | 1,514 | 513 | 20.0 | 563 | 45.3 | 2,261 | 118 | 74.3 |
| Southern 1940 | 23,095 | 18,604 | 41,699 | 7.1 | 23,526 | 1,349 | 542 | 24.1 | 583 | 37.3 | 3,685 | 141 | 75.7 |
| 1939 | 23,242 | 17,037 | 40,279 | 10.6 | 23,502 | 1,321 | 499 | 21.2 | 484 | 34.3 | 2,941 | 138 | 63.9 |
| **Northwestern Region:** | | | | | | | | | | | | | |
| Chi. & North Western 1940 | 34,366 | 15,484 | 49,850 | 12.5 | 30,062 | 1,917 | 679 | 22.5 | 344 | 25.0 | 2,057 | 120 | 47.5 |
| 1939 | 37,367 | 16,179 | 53,546 | 8.7 | 29,788 | 1,827 | 671 | 22.5 | 304 | 21.2 | 1,970 | 119 | 42.7 |
| Chicago Great Western 1940 | 2,413 | 2,870 | 5,283 | 1.9 | 33,695 | 1,814 | 640 | 21.9 | 988 | 72.5 | 3,558 | 121 | 101.9 |
| 1939 | 2,263 | 2,915 | 5,178 | 1.5 | 33,083 | 1,786 | 622 | 21.7 | 976 | 73.1 | 3,518 | 128 | 100.6 |
| Chi., Milw., St. P. & Pac. 1940 | 44,551 | 15,570 | 60,121 | 2.7 | 31,482 | 1,880 | 759 | 25.9 | 477 | 29.6 | 2,659 | 120 | 68.1 |
| 1939 | 44,456 | 15,539 | 59,995 | 2.7 | 29,608 | 1,798 | 721 | 25.4 | 448 | 28.0 | 2,481 | 120 | 65.7 |
| Chi., St. P., Minneap. & Om. 1940 | 3,672 | 4,711 | 8,383 | 7.8 | 19,666 | 1,397 | 531 | 23.1 | 396 | 26.2 | 2,106 | 114 | 55.0 |
| 1939 | 4,139 | 4,355 | 8,494 | 8.8 | 19,143 | 1,370 | 508 | 22.2 | 355 | 24.3 | 1,960 | 117 | 53.6 |
| Great Northern 1940 | 33,921 | 9,211 | 43,132 | 7.4 | 35,019 | 2,269 | 955 | 28.1 | 540 | 30.0 | 2,961 | 109 | 52.3 |
| 1939 | 37,447 | 8,254 | 45,701 | 8.7 | 32,846 | 2,207 | 900 | 26.1 | 434 | 25.5 | 2,504 | 115 | 46.8 |
| Minneap., St. P. & S. St. M. 1940 | 12,161 | 3,506 | 15,667 | 4.7 | 25,007 | 1,424 | 563 | 23.8 | 438 | 28.9 | 1,618 | 101 | 94.2 |
| 1939 | 12,701 | 3,327 | 16,028 | 5.3 | 22,639 | 1,328 | 515 | 22.4 | 368 | 25.0 | 1,403 | 104 | 84.3 |
| Northern Pacific 1940 | 29,543 | 5,329 | 34,872 | 10.9 | 35,053 | 2,159 | 923 | 26.4 | 575 | 32.3 | 3,124 | 134 | 59.9 |
| 1939 | 31,160 | 4,780 | 35,940 | 11.1 | 32,546 | 2,067 | 876 | 25.4 | 481 | 27.2 | 2,706 | 135 | 53.9 |
| **Central Western Region:** | | | | | | | | | | | | | |
| Alton 1940 | 1,623 | 5,265 | 6,888 | 5.2 | 33,165 | 1,329 | 470 | 22.7 | 419 | 30.5 | 3,195 | 139 | 83.7 |
| 1939 | 1,801 | 5,813 | 7,614 | 12.4 | 35,484 | 1,494 | 541 | 24.3 | 451 | 31.4 | 3,706 | 129 | 80.0 |
| Atch., Top. & S. Fe (incl. 1940 | 73,086 | 11,944 | 85,030 | 10.1 | 37,813 | 1,850 | 578 | 20.4 | 429 | 35.1 | 2,692 | 118 | 88.4 |
| G. C. & S. F. and P. & S. F.) 1939 | 75,141 | 10,687 | 85,828 | 10.7 | 34,803 | 1,734 | 555 | 20.1 | 366 | 29.4 | 2,339 | 121 | 74.0 |
| Chi., Burl. & Quincy 1940 | 29,218 | 13,886 | 43,104 | 6.5 | 33,013 | 1,851 | 728 | 23.9 | 565 | 36.9 | 2,758 | 116 | 69.1 |
| 1939 | 28,301 | 13,523 | 41,824 | 6.7 | 32,846 | 1,821 | 717 | 24.5 | 581 | 37.5 | 2,812 | 116 | 69.4 |
| Chi., Rock I. & Pac. (incl. 1940 | 20,195 | 10,776 | 30,971 | 5.9 | 30,703 | 1,590 | 549 | 22.5 | 612 | 47.6 | 2,419 | 114 | 68.7 |
| Chi., Rock I. & Gulf) 1939 | 20,415 | 10,367 | 30,782 | 6.3 | 28,497 | 1,515 | 529 | 22.1 | 599 | 45.7 | 2,399 | 125 | 67.3 |
| Denver & R. G. Wn. 1940 | 12,064 | 3,082 | 15,146 | 3.5 | 32,720 | 1,898 | 786 | 26.3 | 432 | 24.6 | 2,543 | 150 | 57.6 |
| 1939 | 12,081 | 2,943 | 15,024 | 4.5 | 29,938 | 1,814 | 746 | 26.1 | 388 | 22.6 | 2,293 | 154 | 52.6 |
| Southern Pacific—Pacific 1940 | 28,976 | 25,991 | 54,967 | 4.1 | 39,332 | 2,323 | 785 | 22.2 | 705 | 52.0 | 4,453 | 97 | 80.4 |
| Lines 1939 | 31,873 | 24,092 | 55,965 | 6.8 | 37,810 | 2,197 | 730 | 21.2 | 600 | 45.7 | 3,916 | 97 | 76.1 |
| Union Pacific 1940 | 38,014 | 17,645 | 55,659 | 15.1 | 45,017 | 2,023 | 736 | 22.0 | 747 | 51.9 | 4,222 | 120 | 75.1 |
| 1939 | 39,731 | 19,781 | 59,512 | 15.6 | 43,087 | 1,972 | 688 | 21.7 | 686 | 50.2 | 4,051 | 118 | 76.1 |
| **Southwestern Region:** | | | | | | | | | | | | | |
| Mo.-Kans.-Texas Lines 1940 | 5,677 | 3,135 | 8,812 | 7.1 | 30,757 | 1,480 | 507 | 20.7 | 682 | 53.4 | 1,818 | 91 | 67.5 |
| 1939 | 5,849 | 2,870 | 8,719 | 4.2 | 31,826 | 1,567 | 567 | 21.8 | 760 | 55.7 | 2,066 | 91 | 64.2 |
| Missouri Pacific 1940 | 18,212 | 13,736 | 31,948 | 3.2 | 34,240 | 1,849 | 686 | 23.4 | 708 | 48.7 | 3,242 | 115 | 73.2 |
| 1939 | 16,654 | 16,753 | 33,407 | 2.8 | 34,372 | 1,896 | 710 | 24.1 | 715 | 48.1 | 3,238 | 115 | 70.9 |
| Texas & Pacific 1940 | 3,609 | 3,358 | 6,967 | 2.2 | 39,576 | 2,040 | 683 | 22.1 | 824 | 64.1 | 3,076 | 86 | 50.2 |
| 1939 | 3,671 | 3,739 | 7,410 | 2.0 | 35,740 | 1,856 | 633 | 21.6 | 721 | 55.6 | 2,807 | 87 | 50.0 |
| St. Louis-San Francisco 1940 | 18,496 | 4,555 | 23,051 | 2.2 | 28,424 | 1,411 | 536 | 24.5 | 502 | 34.6 | 2,396 | 124 | 65.5 |
| 1939 | 18,401 | 4,669 | 23,070 | 5.2 | 26,340 | 1,323 | 511 | 24.6 | 496 | 33.4 | 2,383 | 127 | 64.6 |
| St. Louis Southwestern Lines 1940 | 2,657 | 2,389 | 5,046 | 3.4 | 34,238 | 1,683 | 599 | 21.3 | 999 | 74.2 | 3,147 | 87 | 83.1 |
| 1939 | 2,634 | 2,538 | 5,172 | 3.0 | 34,336 | 1,707 | 599 | 21.2 | 958 | 73.0 | 2,977 | 91 | 73.4 |
| Texas & New Orleans 1940 | 6,303 | 10,154 | 16,457 | 4.6 | 29,905 | 1,549 | 576 | 23.8 | 674 | 44.5 | 2,549 | 89 | 77.8 |
| 1939 | 7,196 | 10,884 | 18,080 | 5.0 | 29,599 | 1,545 | 575 | 22.8 | 594 | 40.3 | 2,413 | 87 | 74.0 |





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# ASHTON Safety Valves and Gages
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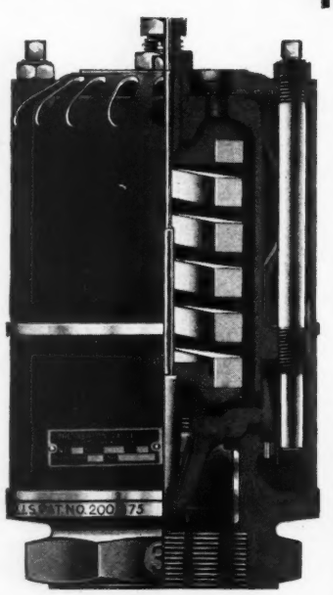

Ashton FC 10 Safety Valve always sensitive and reliable

### — SAFETY VALVES —

Many of the modern high-pressure locomotives have been equipped with the new style type FC-10 muffled and FC open pop safety valves. These safety valves meet increased evaporating efficiency on high-pressure locomotives and have operated efficiently over a period of nine years in road tests and on locomotives carrying pressures up to 300 pounds. Ashton valves have now been on the market for more than half a century. They combine the very best in materials and workmanship for utmost accuracy and safety.

### — GAGES —

The Ashton improved dust-proof illuminated dial locomotive gage 52 DI-5 has a 6¾" double dial with the pilot type on the fireman's side graduated in two pounds increments through a range of the last hundred pounds. This permits quick readings with greater facility. The other side which faces the engineer is direct reading from zero to the maximum pressure. These gages are furnished for standard graduations of 300, 400, 500 and 600 pounds and with white porcelain "non-glare" enameled dials.

Ashton 52DI-5 Double Dial Locomotive Gage showing Fireman's Side with Pilot Readings—Engineer's Side reads from 0# to 500#

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